GOLD PROSPECTING BUYER'S GUIDE

Rock&Gem

JANUARY 2002

THE EARTH'S TREASURES • MINERALS AND JEWELRY

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A CLOSER LOOK

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COVER: A world-class California gold specimen from the Eagle's Nest Mine in northern California, from the collection of Wayne and Donna Leicht, Kristalle, Laguna Beach, California. (Photo by Earl Lewis)

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SHOP TALK

by William A. Kappele

Speed is something most of us in the world of lapidary don't spend a lot of time thinking about. It's not that it isn't important—it surely is—but most of our saws, grinders, sanders and polishers come with factory settings and standard blade and wheel sizes. We don't have to worry about the math. But what do we do when we get a great deal on an 8-inch wheel for our 6-inch grinder? Will it work? Will it run too fast or too slow? And does it matter?

Well, if we are talking about a diamond wheel, the worst that could happen is that we would ruin the wheel by running it at the wrong speed. In the case of a silicon carbide wheel, though, we run the risk of having it shatter and remove a portion of our body that we had planned on keeping. We've all read those warnings on a wheel's label: Do not run above a certain rpm. But just how do we know how fast it is running? If the wheel is attached directly to the motor shaft, it runs at the speed of the motor. Most lapidary motors run at 1,725 rpm, but check the label on the motor to be sure.

While shaft rpm is important, a much more important figure is surface feet per minute (sfpm). This figure (sometimes written as fpm) tells us how fast the outer edge of the wheel is traveling. Remember high school geometry? The outer edge of our wheel moves much faster than the center, since it has a longer way to go. For example, the center of a 6-inch wheel running at a shaft speed of 1,725 rpm travels at around 400 sfpm, while the outer edge travels at over 2,700 sfpm.

If the wheel is attached directly to the motor shaft, one problem becomes apparent immediately. As the wheel wears down, its diameter becomes smaller, and the sfpm drops below the optimum. Of course, if diamond wheels are used, there is no problem, but for those using silicon carbide, a motor with a stepped pulley driving an arbor is the answer. As the wheel wears, the speed can be increased to compensate for the smaller diameter.

Finding the correct speed involves a little math. First, it is necessary to find the circumference of the wheel. To do this, multiply the diameter of the wheel by π (3.1416). For a 6-inch wheel, 3.1416 x 6 = 18.85 inches. Since we are looking for surface feet, simply divide 18.85 inches by 12. The result is 1.57 feet. If we attach the wheel to the shaft of a 1,725 rpm motor, the sfpm formula will be 1,725 x 1.57 = 2,708. If the speed needs to be different, either the motor speed must be changed (which is a very expensive proposition with an ac motor) or a separate arbor must be used.

Since most lapidary machines use an arbor, we need to find the speed of the arbor shaft in rpm. To do this, we multiply the speed of the motor shaft by the diameter of the motor pulley and divide the result by the diameter of the arbor pulley. A practical example will help make sense of this. Suppose we would like to know the sfpm of the grinding wheel on a given machine. To find it, we need to know the rpm of the motor, the size of the motor and arbor pulleys, and the diameter of the wheel. Following is a hypothetical setup:

Motor rpm = 1,725
Motor Pulley = 2 inches
Arbor Pulley = 1.5 inches
Wheel Diameter = 6 inches
Wheel Circumference = 18.85 inches

$$\frac{2(1{,}725 \text{ rpm})}{1.5} = 2{,}300 \text{ rpm}$$

6 x 3.1416 = 18.85 inches
18.85 ÷ 12 = 1.57 feet
1.57 x 2,300 = 3,611 sfpm

Now suppose we have a new 6-inch wheel, and the label says that it should be run at 3,611 sfpm. First, we have to use a little algebra to calculate the arbor shaft rpm:

$1.57(X) = 3{,}611$
$X = 2{,}300$

If we know the motor pulley diameter (2 inches), we can use the following formula to find the diameter of the arbor pulley (X):

$$\frac{2(1{,}725)}{X} = 2{,}300$$

2,300(X) = 3,450 (Divide 3,450 by 2,300)

X = 1.5 inches

If we know the arbor pulley diameter (1.5 inches), we can use the following equation to find the motor pulley diameter (X):

$$\frac{1{,}725(X)}{1.5} = 2{,}300 \text{ rpm}$$

Multiply 1.5 by 2,300 to get:

1,725(X) = 3,450

Divide 3,450 by 1,725 to get:

X = 2 inches

If all this math seems like it's in the same category as a root canal, you can use the following table to do most of the work. Now you have no excuse not to run your machines at their proper speeds.

Please feel free to contact me if you have a suggestion or comment about this or any of my Shop Talk columns. My e-mail is quappelle3@home.com, or write to me at 25231 Pericia Dr., Mission Viejo, CA 92691.

SPEED TABLES FOR COMMON PULLEY SIZES
(Arbor Shaft rpm)

Machine Pulley Diameter (Inches)

Motor Pulley Diameter (Inches)	1.25	1.5	1.75	2	2.5	3	4	5	6
1.25	1,725	1,438	1,232	1,078	863	719	539	431	359
1.5	2,070	1,725	1,479	1,294	1,035	863	647	518	431
1.75	2,415	2,013	1,725	1,509	1,208	1,006	755	604	503
2	2,760	2,300	1,971	1,725	1,380	1,150	863	690	575
2.5	3,450	2,875	2,464	2,156	1,725	1,438	1,078	863	719
3	4,140	3,450	2,957	2,588	2,070	1,725	1,294	1,035	863
4	5,520	4,600	3,943	3,450	2,760	2,300	1,725	1,380	1,150
5	6,900	5,750	4,929	4,313	3,450	2,875	2,156	1,725	1,438
6	8,280	6,900	5,914	4,312	4,140	3,450	2,588	2,070	1,725

THE GO PROSPECT EQUIPMEN

Everything You Need to Start Finding Gold

by Gail Butler

Recreational gold prospecting is an exciting and rewarding hobby that is growing rapidly. Supplying the ever-increasing contingent of gold-hungry prospectors are numerous manufacturers of gold-recovery equipment. Following are important categories of gold prospecting equipment. Within each category are manufacturers that fabricate equipment of that type. Most equipment can be conveniently ordered online, via fax or phone, by mail-order, or through local dealerships.

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Gold Prospector's Equipment Guide *from page 20*

GOLD PANS

The Grizzly Gold Pan by Sluice Box Inc., unlike more conventional circular pans, requires no acquired expertise to operate. With the briefest instruction, requiring only minutes, you can be panning and recovering gold with the pros! This pan processes gravel faster, with less work, than a conventional round pan. For those with physical handicaps, this gold pan is easier to operate than a conventional gold pan.

Grizzly Gold Pan

The Grizzly Gold Pan can be purchased separately for $15, or as part of a more comprehensive gold recovery kit that includes a mini-sluice for recovery of fine gold, extra gold pan seal, and an informative book for $33.95. The Deluxe Panning Kit includes all of the aforementioned, plus a video for $49.95.

Sluice Box Inc.
16745 N. Oak Hill Ln.
Mount Vernon, IL 62864
(618) 244-0505
Fax (618) 244-9191
E-mail: doc@sluicebox.com
Web site: www.sluicebox.com
Contact: Doc Ashcraft

Garrett Complete Gold Pan Kit

Makers of the famous Garrett Gravity Trap gold pan, Garrett Metal Detectors offers two gold panning kits of interest. The Complete Gold Pan kit contains a 10-inch and 14-inch gold pan, classifying screen, Gold Guzzler recovery bottle, two gold vials, and an instructional book, *Find an Ounce of Gold a Day*, by Charles Garrett, founder of Garrett Metal Detectors. This kit sells for $29.95.

Garrett Deluxe Gold Pan Kit

The Deluxe Gold Pan Kit contains 10-, 14- and 15-inch gold pans, a classifier, a Gold Guzzler bottle, two vials, tweezers, an ore bag, the instructional book by Charles Garrett, and a gold panning video. The Deluxe Kit sells for $49.95. Garrett Gravity Trap gold pans have a "drop bottom," which retains gold better than conventional "flat bottom" gold pans. Turn these pans over and you'll see a nifty mining scene stamped on the bottom!

Garrett Metal Detectors
1881 W. State St.
Garland, TX 75042-6797
(800) 527-4011
Fax (972) 494-1881
E-mail: sales@garrett.com

The Professional Gold Pan by Proline Mining Equipment features an effective and user-friendly design. Its side riffles are deeper, covering 40 percent of the pan's side. Made of durable plastic, this pan's "just right" texture speeds the break-in process and helps grab fine gold. It comes in your choice of the three colors that make gold easier to see: green, blue or black. At 14 inches in diameter, the Professional Gold Pan retails for $10.95. The snuffer bottle for sucking up small gold particles sells for $2.95.

Proline Mining Equipment
10002 Ernst Rd.
Coulterville, CA 95311
Phone/Fax (209) 878-3770
Web site: proline@attitude.com

Proline Professional Gold Pan

GOLD SEPARATORS

Gold separators are especially useful if you have too much concentrate to process efficiently by hand panning, or if the gold you are trying to recover is too fine to retrieve by hand panning. Gold separators generally come in two types: "spiral" and "sluice."

Gold Miner Spiral Gold Wheel

The Gold Miner Spiral Gold Wheel features a high rate of gold recovery from concentrates—far better than most prospectors can achieve using a gold pan! It can process over 60 pounds of concentrates an hour, something that manual gold panning can't match. With this separator, the prospector is able to operate gold recovery equipment while the separator handles the "panning" of concentrates. Weighing in at under 10 pounds and with compact dimensions of 20 inches long by 15 inches wide by 12 inches high, it is likely to be one of the lightest, most portable pieces of equipment a prospector will take into the field.

The Gold Miner Spiral Gold Wheel comes equipped with a 13-inch spiral wheel, a recirculating pump with a 500 gallon-per-hour capacity, a spray bar assembly, a catch cup for gold, a drive unit with frame, a tailings container, a pump filter, a carrying case with cover, an instructional video, and a five-year warranty. It sells for $279, plus $10 shipping and handling. Power is supplied to the unit by a 12-volt DC battery (not included).

Gold Leisure Products
10051 E. Clarabella
Clare, MI 48617
(888) 588-6925
(989) 465-1748

continued on next page

Fax (989) 465-1751
E-mail: buccilli@tir.com
Web site: www.goldleisureproducts.com
Contact: Mike Buccilli

Gold Miser Sluice

Sluice Box Inc. manufactures the small, 10-inch-long Gold Miser Sluice used to separate fine gold from a moderate amount of concentrates with far greater efficiency than a gold pan. The Gold Miser Sluice can also be used to sample-sluice an area for gold in place of a gold pan. This separator/sluice sells for $11, or can be purchased as part of a more comprehensive gold kit.

Sluice Box Inc.
16745 N. Oak Hill Ln.
Mount Vernon, IL 62864
(618) 244-0505
Fax (618) 244-9191
E-mail: doc@sluicebox.com
Web site: www.sluicebox.com
Contact: Doc Ashcraft

Proline Highbanker/Dredge Combination Unit

HIGHBANKERS, DREDGES, SLUICE BOXES, ROCKERS AND DRYWASHERS

This category features traditional and popular types of gold recovery equipment.

Proline Mining Equipment offers a great highbanker/dredge combination unit. This 3-inch unit (size is based on hose diameter) gives you two types of equipment in one handy package. Efficient and easy to operate, the unit weighs 155 pounds and features a 5.5 hp Honda engine, a pump with a 2.5-inch intake, and a 1.5-inch discharge designed specifically for use with the 3-inch combination unit, a 14-inch by 48-inch sluice. This unit can pull up to 8 yards of material per hour and retails for $1,649. The unit only, without the pump, is $875. An optional T-80 diving compressor kit for this unit is $230.

Proline 2-inch Dredge

Also by Proline is the 2-inch dredge that combines compact size and portability with the increased suction power found on larger dredges. The 2.5 hp Honda 4-cycle engine and the HP 100 pump work together to pull 100 gallons of water per minute. Quiet engine operation and no need to calculate gas and oil mixture make this a winning combination. This dredge will process up to 2 cubic yards of material per hour, and retails for $995. Other features include a 10-inch by 36-inch sluice bed, a 2-inch by 10-foot dredge hose, a 1½-inch by 42-inch pressure hose, a 1½-inch by 24-inch intake hose, and two polyethylene floats (7 inches by 27 inches). Weight is 59 pounds.

Proline Sluice Boxes

Proline also manufactures a line of sluice boxes designed with the gold prospector in mind. These sluices come with ribbed matting already in place in the sluice head—no need to glue in your own nugget trap! The riffle bed contains an expanded metal/riffle combination.

There are three sizes to choose from, retailing at $59.95, $74.95 and $89.95.

Proline Mining Equipment
10002 Ernst Rd.
Coulterville, CA 95311
Phone/Fax (209) 878-3770
Web site: proline@attitude.com

Although I received no response to my queries from the following company, of particular interest to gold prospectors is their line of rockers, which use a minimum of water to recover gold. They also manufacture highbanker/dredge combinations and drywashers for desert gold recovery. Placer Equipment Manufacturing is the maker of Gold King mining equipment.

Placer Equipment Manufacturing Inc.
431 N. First St.
Buckeye, AZ 85326
E-mail: sales@pacerequipmfg.com
Dealer info: (800) 279-MINE

METAL DETECTORS

Metal detecting, or "nugget shooting," for gold is one of the fastest-growing methods of gold prospecting. Due to the minimal poundage of most detectors, individuals who cannot manage the weight or bulk of traditional recovery equipment find that nugget shooting is their method of choice. Metal detectors are also suitable for those with physical handicaps that would preclude them from utilizing more traditional gold recovery equipment.

On the market today are two types of detectors that can be used to recover gold. First are those that are primarily used to prospect for both placer and lode gold. These are lightweight, no-nonsense machines with little in the way of discrimination modes, used to dial out metal trash such as pull tabs, foil and iron items.

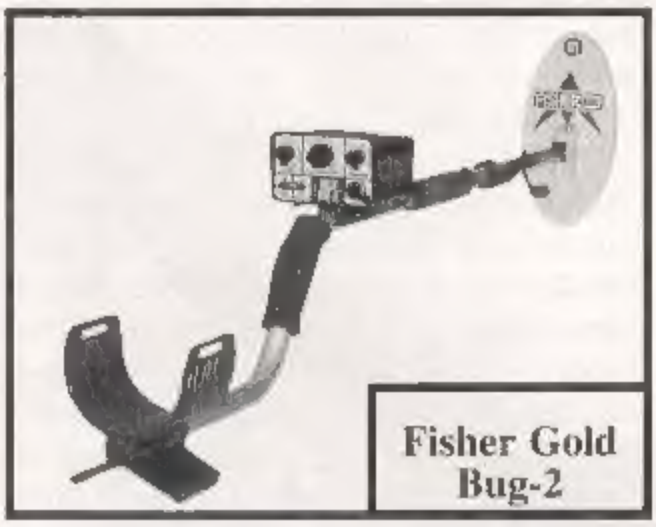
Since gold is the toughest metal to detect, extensive, programmable discrimination modes would tend to tune out the signals of small or deeply buried nuggets. Some of these "gold-exclusive" machines will have some iron discrimination capacity in order to tune out iron waste material or "hot rocks," those having a high iron content.

This is not to say you cannot find coins or jewelry with a primarily gold-locating machine! With my Gold Bug detectors, I have located lost keys and missing lawnmower bolts in my lawn, and have enjoyed the occasional coin hunt along the beach. However, because my primary activity is gold prospecting, I have opted for a "gold specialty" machine.

The other type of detector on the market is a machine manufactured primarily for cache and treasure hunting or coin shooting, but some of these models are suitable for gold prospecting. These machines are usually programmable, with either dials or readouts that indicate the type of target below ground.

Gold Prospecting Detectors

In 1931, Dr. Gerhard Fisher founded the Fisher Research Laboratory in his garage in Palo Alto, California, and began manufacturing the Metallascope, the first-ever patented metal detector. Today, Fisher manufacturers fine detectors for all applications.



Fisher Gold Bug-2

The Fisher Gold Bug-2 is a gold-finding detector with a dust- and moisture-resistant search coil. It operates at the highest frequency of any detector on the market. It has an iron discrimination mode, and operates superbly in highly mineralized soil, bypassing the majority of those pesky hot rocks.

Features of the Gold Bug-2 include a 71 kHz operating frequency that is extremely sensitive to small, deeply buried gold nuggets, an Audio Boost Mode to further aid in finding small, deep nuggets, a foam grip and cushioned armrest, quartz crystal-locked electronics, adjustable Ground Reject Controls, iron discrimination, Low, Normal or High Mineralization selection switch, and a threshold control to set background audio level.

Power is supplied by two drop-in 9-volt batteries. The Gold Bug-2 weighs only 2.9 pounds and comes with Fisher's lifetime warranty. The Gold Bug-2 is hip-mountable (also convertible to chest mount) and retails for $789.95 with either a 6½-inch or 10-inch elliptical search coil. The elliptical search coil allows the Gold Bug-2 to search in areas of heavy brush and around tree roots more easily.

The CZ-20, also by Fisher, is a totally submersible detector that is leakproof to 250 feet, and is of special interest to the gold prospector or treasure hunter specializing in underwater search and recovery of gold nuggets and other valuables. The CZ-20 operates efficiently in saltwater, which tends to have a destabilizing effect on many types of electronics. It has

continued on next page

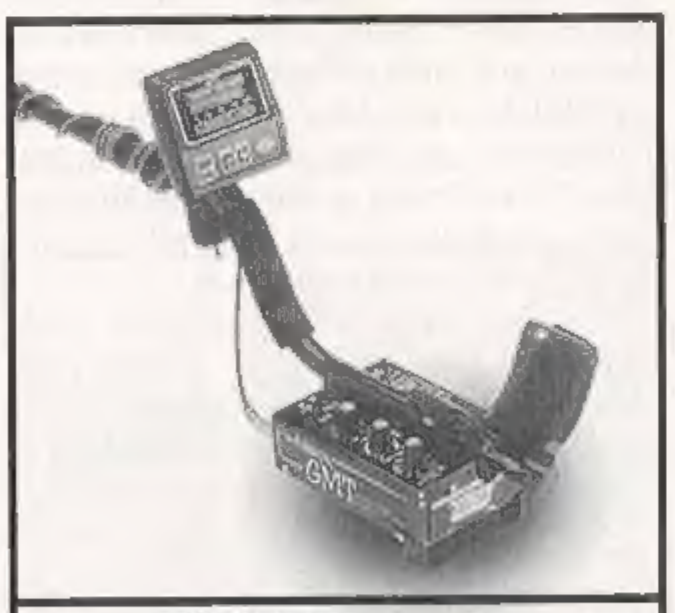
Fisher CZ-20

an adjustable fiberglass shaft (30 to 50 inches) with a padded handgrip, and audio boost circuitry for amplification of weaker signals.

Other features include 3-Tone Target ID, land, freshwater or saltwater operation, push-button pinpointing of targets, push-button ground balancing, Big Target Alert, Silent Search, VLF (very low-frequency) Slow-Motion Discrimination, and Deep-Seeking, All-Metals and Auto-Tune modes. The CZ-20 uses two drop-in 9-volt batteries and carries Fisher's lifetime warranty.

The CZ-20 retails for $1,219.95 with an 8-inch spider coil or $1,239.95 with a 10½-inch spider coil.

Fisher Research Laboratory
200 W. Willmott Rd.
Los Banos, CA 93635-5501
(209) 826-3292
Fax (209) 826-0416
Area dealer info: (800) 672-6731
E-mail: info@fisherlab.com
Web site: www.fisherlab.com



White's Electronics Goldmaster GMT

White's Electronics offers its Goldmaster GMT gold prospecting detector, which ignores harsh ground minerals found in gold-bearing areas. This latest model now has three ways to identify iron without losing sensitivity or depth. An elliptical search coil maximizes search area and allows for easier maneuvering among rocks and bushes. Other features include Automatic Ground Balance, a ground mineralization-value LCD display, 48 kHz operating frequency, push-pad settings, full-time Iron ID Bar Graph showing iron percentage, optional Audio Iron ID, Iron Target Analyzer, a Follow the Paystreak display showing the amount of magnetic minerals in the ground, Variable Self-Adjusting Threshold (VSAT), and Initial Control Settings on each control to get you out hunting right away. A slide-in AA battery system allows approximately 40 hours of hunting, and an optional Nicad Rechargeable System is available. The suggested retail price of the Goldmaster GMT is $799.95.

White's Electronics Inc.
1011 Pleasant Valley Rd.
Sweet Home, OR 97386
(541) 367-6121
Fax (541) 367-2968
Web site: www.whiteselectronics.com

Garrett Scorpion Gold Stinger

The Scorpion Gold Stinger detector from Garrett Metal Detectors is a good-looking gold locating machine manufactured with the gold prospector in mind. Its list of features includes three operating modes, No Motion/All Metal, Motion Discrimination, T/R Discrimination, Calibration (hot rocks and ore sampling), Adjustable Sensitivity/Depth, a 15 kHz operating frequency, Manual Ground Balance, a 10-Turn Knob, Automatic Ground Balance (Motion Discriminate Mode), precision 10-turn audio, Silent Search Mode, automatic re-tuning, Sharp Audio Target Response, Comfort Stem Design with armrest, optional hip mounting, and automatic battery condition indicator (audio). Three 9-volt batteries and a headphone jack are included. The operating weight is 3 pounds, 6 ounces; with the optional hip mount, it is 2 pounds, 11 ounces.

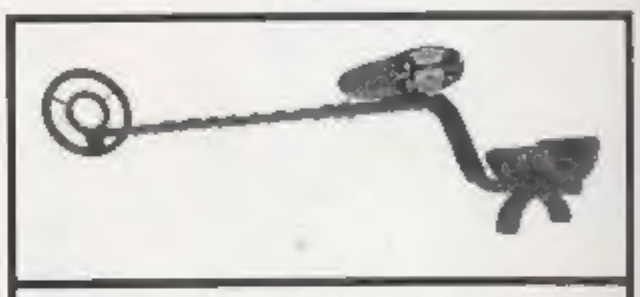
The Garrett Scorpion Gold Stinger retails for $549.95 and includes a 5-inch by 10-inch elliptical search coil, a 10-inch gold pan, and an instructional video. With all the above plus a 3-inch by 7-inch elliptical coil, it retails for $629.95.

Garrett Metal Detectors
1881 W. State St.
Garland, TX 75042-6797
(800) 527-4011
Fax (972) 494-1881
E-mail: sales@garrett.com

The above-listed gold detector companies also manufacture multiuse detectors for both hobbyists and professionals. Check out their Web pages for additional models.

MULTIUSE DETECTORS

First Texas Manufacturing makes the well-known line of Bounty Hunter metal detectors. The Fast Tracker, Quick Draw, Sharp Shooter and Time Ranger detectors transport you into the world of gold prospecting, treasure hunting, and coin shooting.



Quick Draw II

There are three Bounty Hunter detectors of particular interest to gold prospectors. The Quick Draw II features advanced computer circuitry for discrimination and control, three levels of iron discrimination, target ID and depth readout, a low-battery indicator, sensitivity control, and a 6.6 kHz operating frequency. Retail price for the Quick Draw II is $279.95.

Land Ranger

The Land Ranger model may also be used for gold prospecting and black sand searches. It has a large LCD display and ground control features that allow you to compensate automatically for ground mineralization. Other features include Target ID and depth readout, a Ground Balance Monitor, three discrimination modes (Motion, Motion All-Metals, and No-Motion All Metals), four-level iron discrimination, a low-battery indicator, a sensitivity adjustment, a 6.6 kHz operating frequency, programmable operation, two-tone audio discrimination, and touchpad selection. The Land Ranger retails for $549.95.

Bounty Hunter's Time Ranger model can "sniff" out pre-selected targets and

continued on page 56

their depth with its programmable features. Its Smart Trac automatic ground control system makes this detector suitable for gold prospecting. Other features include the LCD target and depth readout, touchpad selection, three-tone Audio Discrimination, Motion, Motion All-Metals, and No-Motion All-Metals discrimination modes, four-level iron discrimination, automatic ground balance, and a waterproof search coil. The Time Ranger retails for $695.95. Both the Land Ranger and Time Ranger include a 4-inch Gold Nugget coil. All Bounty Hunter detectors have a five-year limited warranty.

First Texas Manufacturing
1100 Pendale Rd.

Time Ranger

El Paso, TX 79907
(915) 633-8354
Fax (915) 633-8529
Contact: Debbie Barton

Tesoro Electronics makes two detectors of interest to the gold prospector. The Lobo SuperTRAQ gives fast, accurate and reliable ground tracking in normal and severe soils. Its SuperTRAQ Computerized Ground Tracking System solves the prospector's greatest problem, which is ground balancing, especially in heavily mineralized soils. Regardless of soil type, it will quickly self-adjust to eliminate unwanted minerals, letting you find more gold or treasure with ease.

Tesoro Lobo SuperTRAQ

Other features include a 17.5 kHz operating frequency, Silent Search Discriminate Mode, three ground tracking modes (Normal Soil, Alkali and Black Sand), ultra-smooth operation in extreme mineralization, MAXBoost Sensitivity, pole or body mount, a three-piece knockdown pole, and a 10-inch Elliptical Widescan Coil. The Lobo comes with Tesoro's lifetime warranty. This machine's suggested retail price is $799.

Tesoro Eldorado

Tesoro's Eldorado model combines adjustable ground balance for relic hunting and gold prospecting. With this detector you get adjustable sensitivity and discrimination controls and VCO (Voltage Controlled Oscillator) pinpointing, to make targets easier to dig. Features include microprocessor technology, No-Motion and All Metal modes, MicroMAX Design, a 3¼-Turn Ground Control, low-noise circuitry, frequency shift, a 10 kHz operating frequency, and a 9-inch by 8-inch search coil, and operates on one drop-in 9-volt battery. Interchangeable coils, push-button battery test, built-in mineral rejection, Silent Search Discriminate Mode, and Tesoro's lifetime warranty round out the package. The Eldorado's suggested retail price is $469.

Tesoro Electronics Inc.
715 White Spar Rd.
Prescott, AZ 86303
Catalog or area dealer information:
(800) 528-3352
E-mail: catalog@tesoro.org

The above companies also produce other types and models of multiuse detectors. Check out their Web sites for additional models and features.

HEADPHONES

Headphones are essential for locating small, deeply buried nuggets with a metal detector. Most makes and models of detectors have a headphone jack built into the control housing. Headphones reduce unwanted background sounds such as wind, water and traffic, while still allowing you to hear important sounds and magnifying those faint but all-important gold and treasure signals.

Duraphone makes field-repairable headphones. This means that if the cord goes bad—and eventually the cords on all headphones will short out from constant movement and flexing—you can merely snap on a new cord. No wiring necessary! A set of Duraphone headphones retails for $59.95. A replacement cord sells for $5.95.

Duraphone Field-Repairable Headphones

Duraphone Inc.
P.O. Box 47
Clifton, VA 20124
(703) 631-1219
Fax (703) 222-8625
E-mail: info@duraphone.com
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JR Manufacturing is the maker of Timberwolf headphones. They can be used with virtually any metal detector. You may select from two models, the Lobo and the Predator.

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The Lobo features Single Infinity Volume Control, compact design, a ⅛-inch 90-degree stereo connector, coil wire stress relief, a Mono/Stereo switch, and a high-noise clipper circuit switch. These headphones are conveniently affordable, retailing for $119.95, and come with a limited lifetime warranty.

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continued on page 60

Equipment Guide *from page 57*

phones retail for $139.95
JR Manufacturing
25 Schillinger Rd. N
Mobile, AL 36608
(334) 633-8727
E-mail: jrmfg@zebra.net
Web site: www.zebra.net/~jrmfg

JR Manufacturing Predator Headphones

BOOKS & MAPS

Books can tell you *how* to find gold, but also offer tips on *where* gold can be found.

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(818) 993-0411
E-mail: orderdesk@keenee.com
Contact: Pat Keene

This listing of manufacturers of gold prospecting equipment can get you well on your way to locating and recovering profitable amounts of gold. To discover more models of great equipment by these manufacturers, visit their Web sites.

Good luck and good prospecting!

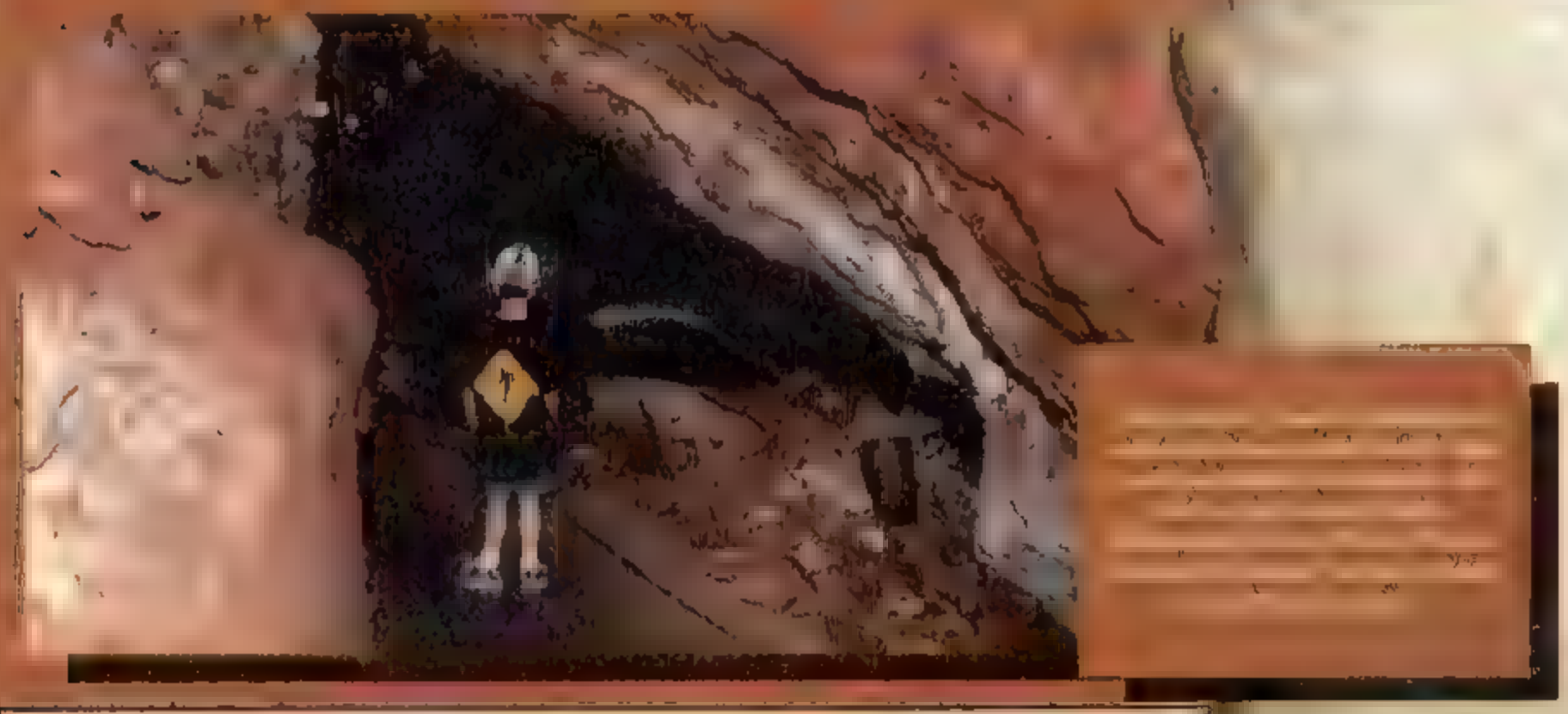
Kartchner Caverns

Special Hard-Hat Tours Are Available for a Limited Time!

by Bob Jones

Strawberries, pelicans, Oscars, bat remains frozen in stone, goosenecks, angels, waterfalls, stone-covered coyote remains, elk horns, ruler-straight rows of soda straws, pencil thin stalactites, rich brick-red mineral streaks running down limestone walls next to snow-white calcite coatings, and tiny geodes locked in those same limestone walls: These are just a few of the fantastic images I saw recently in Kartchner Caverns

Unseen Chambers



Now you can take your own imagination underground at Kartchner and see things the general public will not be able to see for at least a year, maybe two!

My Kartchner Caverns odyssey began in 1999. In December of that year I wrote an article in *Rock & Gem*, the first report offered to rockhounds describing the stunningly beautiful new limestone caverns in Arizona called Kartchner Caverns. This cave complex, ranked among the top 10 in the world, has been open for two years now, and there is still a waiting period for reservations to visit the portion of this underground fairyland that is open to the public.

Kartchner Caverns consists of two huge caves and a number of smaller complexes. Currently, the guided tour takes visitors into the Throne Room where Kubla Khan, the system's largest stalagmite, is the central attraction, surrounded by myriad cave formations. Passing through the shoulder-narrow Imaginary Passage, visitors arrive at the Rotunda Room, larger than two football fields and replete with cave formations.

The entire tour takes about an hour and a half, and is a continuous treat as you view formation after formation, all still alive and growing in this great natural wonder, the finest living cave in America that is open to the public.

The current tour, as wonderful and worthwhile as it is, only takes you through a portion of this great subterranean wonder. There is an even larger portion that has never been developed! Now I can report that this portion of the Kartchner complex is far more beautiful, far more stunning than the public portion. I can make such a statement because I just completed a hard-hat flashlight tour of The Big Room, Echo Passage, Cul de Sac Passage and the Strawberry Room. This was only the second invited group tour into the closed part of Kartchner Caverns.

My tour was courtesy of Ken Travous, Director of the Arizona State Parks Department, and his staff, working in concert with Friends of Kartchner Caverns State Park. I'm working with Friends as liaison to the rockhound community as we raise funds to help develop the closed part of the cavern complex, which I feel is the most beautiful portion of the entire underground system. We went into what's appropriately called The Big Room. It is larger than the public portion of the cavern and, in my opinion, more remarkable.

If The Big Room is the more attractive part of the caverns, how come it was not developed first? That's an obvious question with an obvious answer. It so happens that The Big Room plays host to upwards of 2,000 bats from April to late September. The bats, *Myotis velifer*, are insect eaters who live the rest of the year in Mexico. Eons ago they found Kartchner to be a wonderful place to raise their young. Since the state's effort is to preserve the cavern in as pristine a condition as possible while opening it to public viewing, special studies had to be made to determine just how to develop this portion of the complex while maintaining the bat colony. This required extensive study, so it was decided to focus initial efforts on opening the Throne Room area, that part of the cavern away from the bats.

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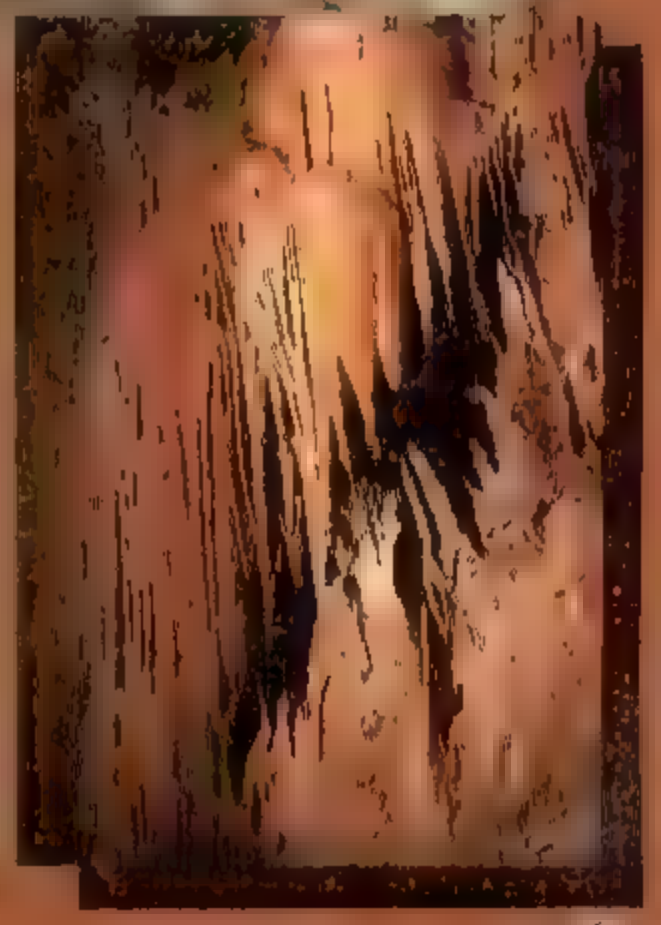


Kartchner Caverns' Unseen Chambers *from page 29*

To achieve the goal of maintaining the cavern system intact and keep it developing, all sorts of careful measures were taken. No gasoline-powered machinery has ever been run inside the caverns. The hundreds of cubic yards of concrete for ramps and borders were hand moved in buckets and wheelbarrows into the caverns for the laying of the walkways and curbings. The curbings are extra high so wash water can flush away the human detritus—lint, hair, spores, etc. This flush water, which in most caves is simply allowed to accumulate at some low spot, is pumped out of Kartchner, at a greater but very wise expense!

The cave temperature is about 68 degrees F and the humidity runs close to 100 percent. Monitoring equipment carefully controls both these conditions, so we did not need jackets when we went into this subterranean fantasyland. In addition, since the caverns are still active, there are huge faults and cracks running through the limestone masses, which have to be stabilized and then monitored with very sensitive in-place instruments that can sense movement as minute as a hair's width. Every effort has been made to keep the place safe, stable and unchanged.

After we passed through double airlock doors to get into the entrance tunnel, a 750-foot walk brought us to the first of three airtight doors that guard the mysteries of The Big Room. The doors don't inhibit the movement of the bats, because they use echolocation to navigate around stalactites and stalagmites to get to the original, and apparently only, natural opening to this wonderland.

As we wandered past piles of bagged construction materials, electrical control panels, and myriad wires and lines, our flashlights quickly highlighted slender stalactites, clusters of knobby stalagmites, paper-thin banded, colorful draperies, and a profusion of "bacon" formations. You can't have bacon without eggs, and sure enough, several times along the trail I was able to spot snow-white, shallow, convex stalagmite tips with a yellowish center. Water was still accumulating in them and continuing to build yet another spectacular formation to join the thousands of others. Some of the draperies extended a few feet along the sloping ceiling, then suddenly turned 180 degrees back on themselves to form gracefully rippled gooseneck drapes.

In the rooms we trailed through, huge blocks of limestone were stacked helter-skelter where they had fallen from the ceiling. Some had stalactites still in place, and shattered since gravity had hurled them to the floor. This rubble, the result of ground movement and the dissolution of limestone along cracks and fractures, formed huge, angular mounds in the rooms, piles the original exploring discoverers had to climb over and under to search out the extent of the cavern.

All that exploration showed that the cavern system is at least two and a half miles long and is replete with every imaginable type of cave formation. Everywhere you look you can imagine some creature, some geometric shape or ghostly form, some oddity that elicits wondrous images in your mind.

My favorite spot is the Strawberry Room. First, many of the formations are colored a rich brick red by strong iron oxide impurities, which invaded the flows and formations as they developed. Second, right in the middle of the area is a huge, rounded flow, maybe 20 feet across at the base and at least that high, that resembles a strawberry in form. The entire strawberry formation is a lovely pink-red color, again thanks to iron oxide.

It was hard to move along the trail, but not because it is difficult to negotiate, for it is wheelchair accessible. It was tough to continue along because there was so much beauty and mystery to see that I just wanted to stand in awe and wonder of nature's ability to create the unexpected and unusual. I've been in a few underground caverns in my life, but never have I seen anything that approaches this most brilliant and colorful of all cave creations.

Earlier, I suggested that you, too, could walk in The Big Room, the Cal De Sac, the Strawberry Room and more. You can—but it is going to cost you. This large portion of Kartchner will not be ready to receive the public for at least another year and maybe more. So the Friends of Kartchner Caverns, working in concert with Travous and the Arizona Parks Department, have arranged for small group tours into The Big Room as a fundraiser. Because of work ongoing in the area and the need for guides to be with anyone going into The Big Room, individual tours will not be allowed.

The current plan is to allow groups of up to 40 per day to sign up, so you will have to get your club or your friends together on this. The cost is $150 per person. A donation of $5,000 will allow a group of 40 to take the tour, 10 at a time. That cuts the cost for everyone. The Tucson Gem & Mineral Society, for example, has already set up a group tour. Other clubs whose members come to Tucson during the show season are making the necessary plans to visit the cavern.

The tour is already available and will continue to be available during the time of the Tucson shows, from late January to mid February. There will be sign up spots at designated places during that time period, a booth at the Tucson Gem & Mineral

Soda straw stalactites up to 21 feet long hang from the ceiling of the Throne Room. (K.L. Day photo)

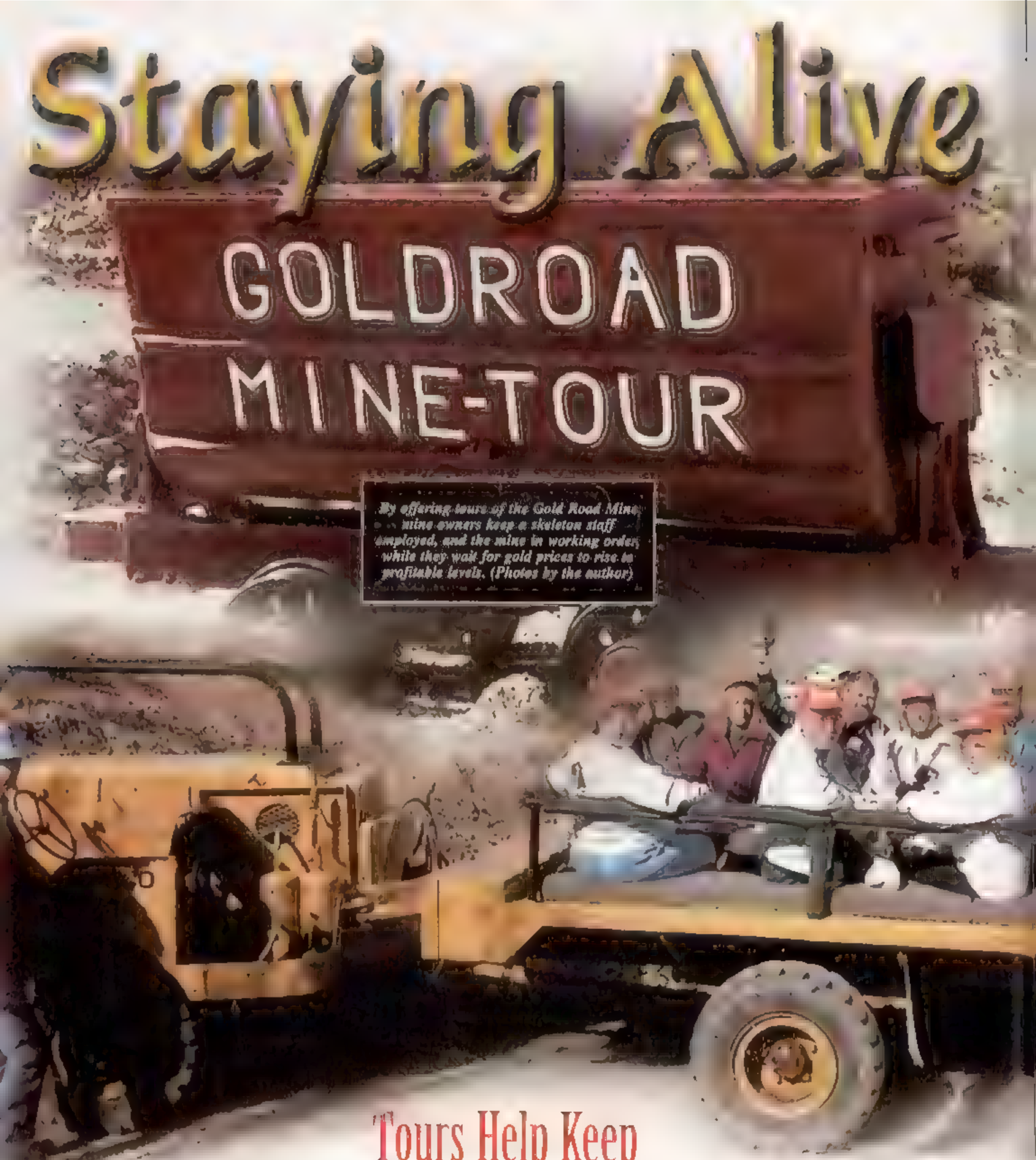
Society Show and locations it shows that open earlier at the Executive Inn and the Quality Inn Suites. Even if you are alone, you can join others who want to make this spectacular once in a lifetime trip. It should be easy to put together a group of 20 or more during the Tucson shows.

Oh, yes. I forgot one small, but very important, detail. Did I mention that cameras are not normally allowed anywhere in Kartchner Caverns? Well, if you sign up for one of these special hard hat tours, you can *bring your camera* and take pictures of the Strawberry Room, the Coyote Skeleton, the soda straw stalactites, the cave bacon and eggs, and anything else that intrigues you, even the little geodes locked in limestone. This is a real privilege. All we ask is that you sign a waiver promising that the photos will be for personal use only. Just take a look at the pictures accompanying this article, then imagine the fun of showing your friends shots of you standing right there among some of the world's most beautiful cave formations.

One of the real benefits I see for dealers here is that this gives you a chance to say "thank you" to your employees, your families and your good customers. Why not give them a hard hat tour while they are visiting Tucson in 2002? Sign up for as many tour spots as you need and surprise your friends. Kartchner is an easy 50-mile drive east on Interstate 10 to Exit 302.

If you or your club want more information on this incredible opportunity, drop me a note at the *Rock & Gem* office and I'll be happy to call and chat with your leadership or take your group reservation for a tour. It will only be available from now until the bats return in April. When they show up, this tour opportunity will cease, never to be available again!

Staying Alive



By offering tours of the Gold Road Mine, mine owners keep a skeleton staff employed, and the mine in working order, while they wait for gold prices to rise to profitable levels. (Photos by the author)

Tours Help Keep the Gold Road Mine Poised for a Comeback

by Kathleen Connell

Times have been tough for American gold companies the past few years. The cost of production outweighs their profit margin. Mines have been closed and their employees laid off. What can a company do while it keeps its milling operations ready for a quick start-up? Addwest Minerals has found an answer by opening up a gold mine tour in northwestern Arizona.

As old state Highway 66, popularly known as Route 66, winds its way down from Kingman, Arizona, through the crevices of the Black Mountains, to the outskirts of Oatman, it passes through one of the richest gold fields in the entire state. As with a hundred other gold tales, the gold ore here was discovered by accident, in this case by an amateur unaware of the fortune he held in his hands.

Jose Jerez (or Jeneres, or Jersey) was a poor man supporting nine children and his Indian wife, Maria. He eked out a meager living by hunting rabbits and mule deer or javelina, and surviving on a few crops that could be grown during the rainy season. Additional supplies were grubstaked by a Kingman merchant by the name of Henry Lovin. Jerez had told Lovin that he had once stumbled upon an area he believed to have good ore, but could not remember quite where he had seen it. The inevitable happened one day when the storekeeper told Jerez to come up with the gold samples and location or the grubstake would be cut off until he saw some collateral. The year was 1899, and Jerez's grocery bill hovered around $3,385.

Jerez decided to go out into the mountains with his burro and attempt to find some interesting samples so that Lovin would know he was trying to relocate the lost find. Perhaps then credit would be advanced for a few more months. He went north in no particular direction, letting the burro take the lead. When he had reached the area around the Sitgreaves Pass, he stopped to drink and rest in an arroyo. The red-stained cliffs in that area are quite picturesque. They provided enough shade and ambiance to eventually lull the old man to sleep. When he awoke, the burro was missing, and during his attempt to relocate her Jerez picked up some interesting looking quartz rock specimens he believed contained some gold. When he found his traveling companion, he decided to head back toward Kingman and show Lovin the few samples he had recovered.

Upon returning to Kingman, he entered the grocery store and displayed to the storekeeper his small gold find. To his surprise, Lovin became excited and told Jerez his bill was paid in full, that indeed he had found rich gold ore. Jerez quickly staked a claim, and today the mine is known as the Gold Road Mine.

The gold ore Jerez showed to Lovin assayed out to 40 ounces per ton. Within a few months of staking the claim, a 15 foot shaft had been excavated. Work was slow and tough, and Jerez and Lovin both jumped at the opportunity to retire rich when a group of Los Angeles investors purchased the claim from them for $50,000. At this time, it was not unusual for rich claims to exchange hands often. Soon, the mine was resold for $275,000 to the right type of investors, those that had the ingenuity and capital to begin major production. A gold mining venture was now set in motion with the infusion of $500,000, which hired 180 workers to begin full scale production. The most prosperous years of 1905-06 helped surge production levels to over 140,000 ounces recovered, which was worth in excess of $2,250,000 by 1907.

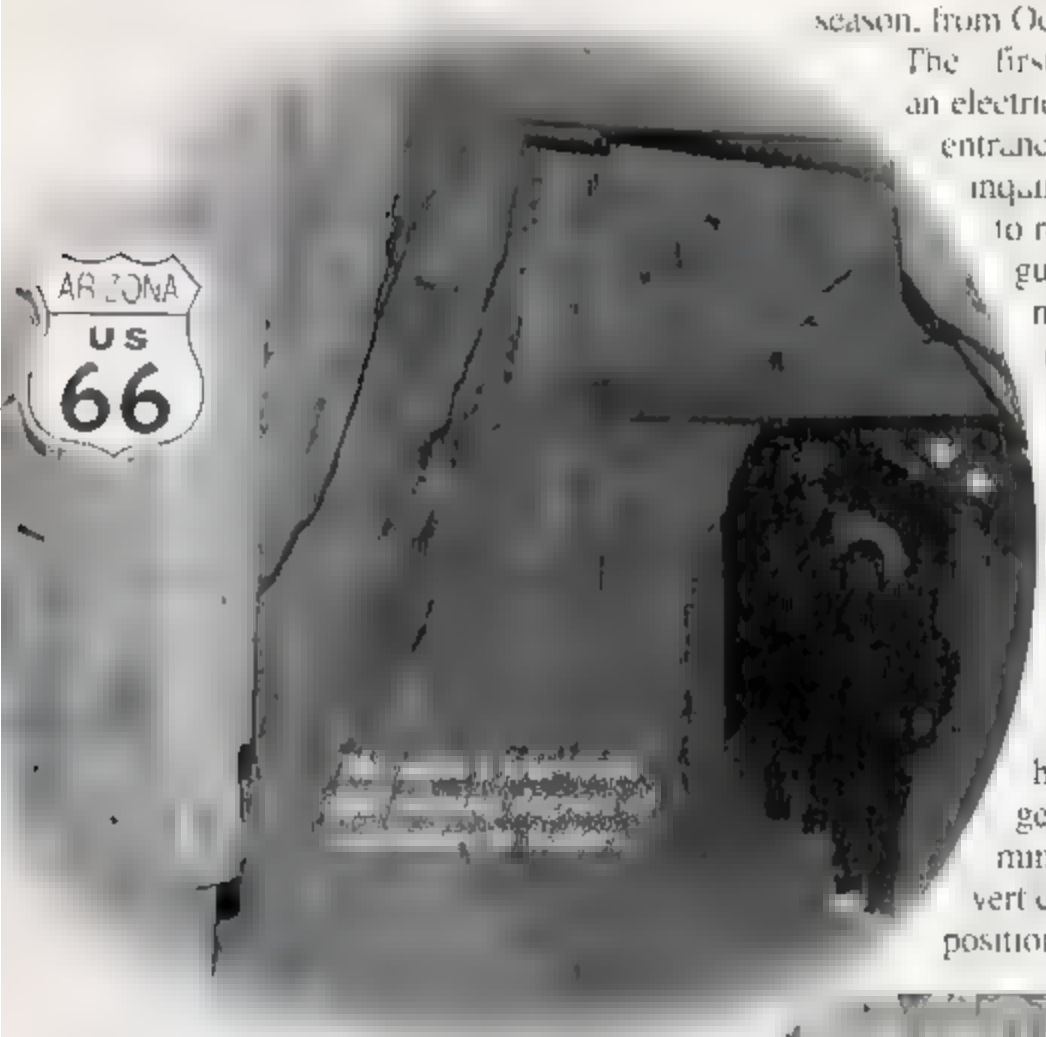
Two miles south of the Gold Road Mine there arose out of the dust and tumbleweed the town of Oatman. One day the trail consisted of a few half-starved jackrabbits and lizards, and within a few months several thousand civilized – and some uncivilized – inhabitants had made the area their home. Oatman was actually settled by the workers of another high-grade ore producing claim called the Snowball. Many more mines soon followed, including the Tom Reed and the United Eastern, pushing the population to around 5,000 by 1916. Oatman, it is popularly believed, was named after Olive Oatman. She had been kidnapped by Apaches in 1851 and was then sold to the Mohave tribe. Some say that the town was actually named after her son John, a miner, whom she bore in a union with a Mohave brave.

Today, the mines are shut down in this region, as it is not profitable to recover any gold. Production costs far exceed any profit that could be realized. This has been occurring with regularity in major mines throughout the country. The mines in these mountains are ready to produce once again when the price of gold hits approximately $320 per ounce, depending on equipment and milling operations. Until that time, owners must remain shut down or devise another way to make ends meet.

continued on next page

On a clear day, from the entrance of the Gold Road Mine you can see beyond the peaks and gullies and clear across the flat lands well into the Nevada frontier. When hard times hit the gold mining operations, the vast, rugged, natural beauty of this area led the owners and the plant overseer to devise a plan to open a mine tour. It would help keep a few loyal employees receiving a regular paycheck while they kept the mill ready to resume operation when the price of gold rose.

I have been on several mine and cavern tours over the past 10 years. Each one has its own unique draw. The Gold Road Mine Tour is not just one tour, but four very different and unique experiences. In the past year, the company has expanded its tour choices and upgraded its facilities.



Oatman is boiling hot in the summer, when temperatures can reach well above 110 degrees. Bullhead City and Lake Havasu are an hour or less away, and experience some of the hottest temperatures in the country. The elevation of the Gold Road Mine is slightly higher, so temperatures are a tad cooler. My first visit to the mine was with my rock club at the end of August. We went on the shortened tour, which covered the original Gold Road Mine that Jerez actually began excavating.

We arrived at noon and proceeded to an open-air cart. After being seated in this modern-day mining vehicle, we were driven to the mine entrance, which was over a quarter of a mile up an extremely steep grade. Nobody would want to traverse this road by foot on a summer's afternoon. From the entrance, the scenery was breathtaking. Old Route 66 is only a few hundred yards away. The side of the road and culverts, to let rain water flow down the mountain, were built with the natural rocks of the area to help keep the road embankment in place and the natural run-off flowing under the asphalt. Before entering the mine, we looked to the horizon and could see smoke from a power plant in Nevada.

Our guide gave a short history of how Jerez found the gold and began excavating. As soon as we entered the mouth of the mine, we could feel the brisk breeze that was pulled through the opening. It kept us quite comfortable for the entire tour. But when we revisited the mine in November, we needed a good sweatshirt or winter coat to protect us from the cold. The majority of visitors tour the mines during the "snowbird" season, from October through April.

The first thing I spotted was an electric wheelchair just inside the entrance. It is always good to inquire ahead of time if you need to reserve it for your tour. Our guide took us through the ½-mile tour, pointing out the different mine structures and discussing drilling equipment. There is a nice, vertical mine chute located in the main tunnel, and in a side drift is their big shaft, No. 3. The shaft has a vertical drop of 1,400 feet, and it rises another 300 feet above your head. One of the unusual geological formations in the mine is a plate that is standing vertically. It was placed in this position during an earthquake. It cannot be drilled into due to its hardness.

The guides on this particular tour are especially proud of showing the group the vein of gold. They turn the lights off in a small drift area. Special ultraviolet lights mounted near the ceiling of the mine are directed toward the ore, and the trace elements containing the microscopic gold fluoresce.

At the end of the tour, when we emerged from the mine, our guide took us over to an area that contains tailings from one of the tunnels we did not get to explore. Each individual was allowed to pick through the scattered ore and take as many free samples as they liked. After we returned to the main entrance, we were escorted into a room where ultraviolet lights are mounted above a table. When they turned off the lights, the short-wave spectrum picked up the small specks of gold in the trace elements, making it look as though there were a small vein of gold in some of the samples. It is a great way for children to obtain microscopic amounts of gold to take back to their schools, where most science departments have an ultraviolet light available for individual teachers' use. The best samples of microscopic gold were in white quartz rocks having a brown ridge throughout.

The cost of this tour was $12 for adults and $6 for children 12 and under. Each of the four tours is priced differently, as some run up to four hours in length. Group prices are available on some of the tours. The tour of the original Gold Road Mine, which runs for about an hour, is fun for those just wanting to experience going into a mine or for those with families. Die-hard gold prospectors may wish to experience some of the other tours, as they compare old time techniques to modern equipment.

One such tour is the Extended Tour which encompasses the original mine shaft and then brings the group into the modern world.

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Historic Oatman, along Old Route 66, preserves the spirit of prospecting days.

of mining. Air duct vents, through which fresh oxygen is pumped into the inner depths of the working mine, are very visible. The work in this portion of the tunnels was halted in 1998, when the price of gold plummeted. According to some of our guides, they still go into the tunnels at the end of the day and continue searching for fresh gold ore deposits so that when the price of gold reaches production levels they will know where the promising finds may occur. If prices suddenly soar, this particular tour may be put on hold. The cost is $24 per individual.

For those with great ambitions, who are physically fit and have plenty of time for a real adventure, the Extreme Tour is available. You undergo a safety lecture, receive a hard hat and lantern, and set off on the original tour. Where the original tour ends, the extreme tour begins. At the end of the first shaft excavated there is a wooden door that lets the real mining enthusiast enter into a different world. You will go into tunnels inaccessible to the regular tourist, climb down ladders into the inner workings of the mine, and see what only real miners experience. At the end of this four hour trek, showers are available, as participants can become quite dirty from the experience. This particular tour is only available Friday, Saturday and Sunday at 8 a.m. Reservations must be made a few days ahead of time. The current cost is $50.

Since my club went there in November, another tour has been added. It is an overview of the milling operations, where the ore is processed and crushed. Our group climbed up onto metal scaffolding (those who don't like heights may want to avoid this) to view the buildings and settling pond. The tour has been modified since we were there, and now goes into detail about the milling process and the equipment used. On this new tour, you will see a variety of equipment, such as the crusher circuit and fine ore bin. You will be taken to the settling, or tailings, pond. The cost of running the operation is discussed and there is plenty of opportunity to ask questions. Depending on their ages, it may be too technical for younger family members, and is more for those who are into all aspects of mineral recovery. The cost is $.0 per individual.

It appears that Adawest Minerals and Larry, the manager of the site, are dedicated to making this experience a pleasant one. The last time I was there, they were in the process of completing a small RV park at the entrance to the mine operations. I felt that I could see forever from the RV pad. Trail rides are offered for those who are interested, and occasionally there are murder mystery tours. These are held only a few times a year, and reservations must be made. For information about the tours, write to Gold Road Mine, P.O. Box 869, Oatman, AZ 86433, or call (928) 768-7600, or fax to (928) 768-9588.

I have been told that longer RVs are rather difficult to maneuver down the winding roadway approaching the mine from Kingston, Arizona. It is easier to come from the south entrance, by way of Oatman. Individuals pulling a 32 foot fifth-wheel need to pace themselves. Oatman has very narrow streets, and with cars parking on the regular thoroughfare, large RVs need to take the route with caution.

After having taken the mine tour of your choosing, Oatman is the place to head. The town is famous for the many burros rambling in the streets, stopping traffic and poking their heads into store entranceways. The town is just over two miles from the Gold Road Mine entrance. All the stores are made of wood, a week before our November visit, one of the restaurants burned to the ground. Staged gunfights are held often, and it's a nice place to pick up a snack and souvenir before heading elsewhere. Back when the locality was a gold boomtown, the majority of the women felt it was a great place to raise children, as there was little crime.

The gold prospector sometimes needs to get away from the hard work his hobby creates to relive the past and look toward the future. At the Gold Road Mine Tour, you get an education in hard rock mining, made into a fun learning experience.

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FINDING GOLD IN ARIZONA

It's Easy When You Know Where To Look

It's easy to lose a mine among the rugged canyons and ridges of the Superstition Mountains. Sheri Weinberger photo.

www.rockngem.com

Rock & Gem

by Sheri Weinberger

There's gold, and it's glittering
and haunting,
It's luring me on as of old,
Yet it's not the gold that I'm wanting
So much as just finding the gold

So lamented Robert Service in his poem "Spell of the Yukon." Gold fever is gold fever whenever and wherever it strikes. Arizona is no different.

Arizona's lore and legends abound with tales of old prospectors stumbling out of the desert or mountains after finding astounding amounts of unbelievably high-grade gold ore or nuggets. Many times they carried samples in their backpacks, which mysteriously disappeared at the last watering hole or were stolen at gunpoint. Some weren't lucky enough to carry their story out in person, their bodies were later discovered, perhaps with a cryptic map or message in a shirt pocket.

The oft repeated and most versioned tale of the "Old Dutchman" Jacob Waltz and his lost mine is one of the best-known legends in Arizona. Even the basic fact of his nationality is misrepresented, he was not Dutch, but German, born some time between 1808 and 1810 near Oberschwandorf, Württemburg. Some variations claim there were three Dutchmen; most stories depict just one prospector with his burro.

Furthermore, there is no real agreement on even the general location of the Lost Dutchman Mine. One account puts it near Four Peaks in the Mazatzal Range northeast of Phoenix. Another places the site's location in the Hayden Atlas, west-northwest of Phoenix.

Its most common setting, in the eerily named Superstition Mountains east of Phoenix, makes it all that much more mysterious and appealing. The first recorded inhabitants of the area, the Hohokam and Sinagua Indians, followed by the Pimas and Apaches, believed these mountains rising starkly from the east edge of the Valley of the Sun were sacred and evil. The Apache, known for their fearlessness, would die rather than go into the home of their Thunder God, unless it was to avenge trespassers into this sacred area. Early farmers, growing hay for the horses of the nearby Army forts, named the mountains the Superstitions because of the strong beliefs of the Pima about the looming mountains.

In the 110 years since the death of the Dutchman, fortunes have been lost in seeking through the torturously rugged canyons and sharp ridges of the Superstitions for the gold. The cause of death of more than 100 known people has been directly attributed to their search: dehydration, starvation, murder. Many gold hunters died old, obsessed people sure they had found the mine but then lost it again.

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Above: People have enjoyed recreational gold panning in Arizona for many years. Below: Water sluices over a terrace at the Lynx Lake Mineral Withdrawal Area. (Photos courtesy Arizona Mines & Mineral Resources Museum)

The hunt continues, based on maps said to be the real, authentic map, discovered in an old attic or among a great-uncle's papers, or by piecing together the clues supposedly spoken by Waltz during his life or on his deathbed.

As the times change, so do the rules. Today, even if the gold were found in any of the most commonly mentioned locations, it would be illegal to mine it. These areas have been declared National Wilderness Areas by Congress, and are thus off limits to mining. Fortunately for recreational gold explorers, that doesn't mean that all of Arizona's off limits.

In searching for nature's buried gold it helps to understand a little about how gold behaves. There are basically two types of naturally occurring gold lode ore in which the gold deposits are locked within bedrock and placer gold. Placer gold results from the erosion and gradual destruction of the gold-containing rocks. Over the eons natural forces of nature—wind, rain, temperature changes, earth movements, and even chemical interactions—sift gold out of the disintegrating rock. The gold survives this weathering and ends up, rather than breaking. Meanwhile, Mother Nature also acts as a gold pan, using water to move and concentrate the freed gold, even in the desert. This freed, untreated and released gold is called placer gold.

For recreational gold hunters, placer gold is the sought after prize. Where to go to seek this prize? Two things must be considered when looking for suitable gold hunting locations. Is the area favorable to the occurrence of gold, and is it open to recreational gold panning?

Logic says to go where placer gold has been found in the past. While just about all areas of Arizona have given up a little gold, the central and southeast parts have been the most productive over the years. Hot spots in the past were Hassayampa River, Patagonia, Cave Creek, the Bradshaw Mountains, Lynx Creek, Big Bug Gulch, Humbug, and Lake Pleasant.

Of those areas likely to carry gold, which ones are open to recreational gold panning? Ralph Costa, mining engineer for the Bureau of Land Management (BLM) in Arizona, says, "Recreational mining is not recognized by the mining law. What a person is doing is either mining or not mining. There are however three levels of use designated: casual, mechanized earth moving equipment, and plan of operation."

Costa explains, "The surface management plan (43 CFR 3809), in effect since 1980, defines casual use as mining done only with hand tools such as pick and shovel, gold pan, hand operated shaker boxes, and metal detectors. No filing is required for this level of mining, but it is up to the individual to determine the land is indeed public, that it is open to mineral entry, and it is not already claimed (unless arrangements are made with the owner).

"Mining with mechanized earth moving equipment involves the use of suction dredges, motorized dry washers or shaker boxes." Costa says. "In addition to determining the availability of the land for casual use, the miner must also post a bond for reclamation. Casual and mechanized levels are considered by the mining laws to be exploration. The third level, plan of operations, is for full-fledged mining."

Costa warns, though, "The mining laws of 1980 were superseded in January of 2001. Those new laws are currently under review, and in the process of being modified. They may be accepted, changed or may revert back to the 1980 laws. Before doing any mineral searching, check with the BLM field office nearest the land that interests you. They will be able to tell you the status of the law and specifics about the area."

Of Arizona's 114,000 square miles, about 44 percent is federally owned land: national forests, wildlife refuges, parks and monuments, or land management areas. Where do you start? If you don't want to worry about whether a 1980 or 2001 set of laws prevails or about accidentally jumping someone's claim, mineral withdrawal areas and prospecting clubs offer hassle free fun.

ARIZONA GOLD PROSPECTING CLUBS

Desert Gold Diggers
5021 E. Pima St. #D
Tucson, AZ 85712

Mesa Gold Diggers
7830 Paseo Escondido
Prescott Valley, AZ 86314

Arizona Prospectors Association
PO Box 68053
Phoenix, AZ 85082-8053

Roadrunners Prospectors' Club
PO Box 56804
Phoenix, AZ 85079
(602) 274-2521

Gold Prospectors Association
of Tucson
5425 E. Broadway #216
Tucson, AZ 85711

Havasu Gold Seekers Club
PO Box 3281
Lake Havasu City, AZ 86405-3281

Mohave Prospectors Association
PO Box 6446
Kingman, AZ 86402-6446

Mineralogical Society of Arizona
PO Box 962
Phoenix, AZ 85001

MINERAL WITHDRAWAL AREAS

Lynx Lake and Lake Pleasant mineral withdrawal areas are set aside for recreational gold panning. No claims are allowed and no permits required. Both were hotspots for gold mining in the past, and there is a high probability of seeing some gold.

The Lynx Lake Mineral Withdrawal Area (southeast of Prescott in Prescott National Forest) encompasses an area of about six miles along Lynx Creek from Lynx Lake south to the small town of Walker. This area was the site of some of the best gold mines in Arizona. With a pick, shovel and gold pan, everyone is welcome to try their luck with the elusive mineral. There are, of course, many rules to protect the environment from the overzealous or another's person in the throes of gold fever.

- Mutilating, defacing, removing, disturbing, injuring or destroying any natural feature or any property of the United States is prohibited.
- Use of any motorized or mechanical equipment or mining aids other than hand pans, metal detectors, and hand tools such as picks and shovels, including sluice boxes, dry washers, gold screws, gold bugs, rocker boxes, wheelbarrows, etc.) for mineral extraction within the boundaries of the withdrawal area is prohibited.
- Violation of these prohibitions is punishable by a fine of not more than $500, or imprisonment for not more than 6 months, or both.
- Pick/shovel excavations may only be done in conjunction with gold panning and metal detecting. Gold must be made below the high-water mark of the stream channel. All excavations must be filled in before leaving the area.
- Do not cut trees, limbs or brush, and do not dig up ground cover.
- Pack out everything you brought into the area, especially trash.
- Do not wash yourself or your dishes in Lynx Creek or any of its tributaries. All wash water must be contained and disposed of on national forest land. Bury human waste 4 to 6 inches deep and at least 200 feet from the stream channel.

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Finding Gold *from page 48*

• If a fire is necessary, build it safely and do not leave it unattended. Extinguish it and naturalize the area before leaving.
• Camping is limited to a 14-day stay within a 30-day period.

Lynx Lake is at an elevation of over 5,000 feet, so it gets cold in the winter, but is generally mild in the other seasons. The creek usually flows year round, except in drought years.

Lake Pleasant Regional Park, about 30 miles northwest of Phoenix, allows gold panning within its boundaries. Maricopa County manages this 14,000-acre park. Historically, the streams coming into the north end of the lake and their tributaries have been the most productive. There is a small entrance fee. As with Lynx Lake, there are some rules:
• Gold panning is permitted, but traditional rock collecting is not allowed.
• No mechanized equipment may be used.
• No plants may be disturbed.
• Any holes or other evidence of panning activity must be obliterated before leaving.

Lake Pleasant's elevation is just 1,500 feet, so summers can be very hot, the rest of the year is usually nice. During the summer, as more water is released from the reservoir, more shoreline appears, opening up areas not usually available during the wetter seasons, such as coves and otherwise inaccessible islands. The creeks generally dry up or become a series of pools. While this makes it easier to get to what is normally the bottom of the creek bed, it also takes away the water for traditional panning.

PROSPECTING CLUBS

Prospecting clubs offer gold hunters an opportunity to learn about methods, equipment and places to go. Some have their own claims for the use of their members. Again, this eliminates the worries and hassles of finding a place to search.

George Volker, Claims Director for the Desert Gold Diggers, a Tucson area prospecting club, says, "The local club route might be the best for the amateur to take." His club has 17 mining claims, and maintains a plan of operations with the Forest Service for the claims and use of tools. "A member is allowed to use any of the claims at any time and keep whatever gold he or she finds. Usable tools include gold pans, drywashers, dredges and metal detectors." He says there are prospecting clubs based in most towns in the placer gold areas of Arizona.

STRIKING OUT ON YOUR OWN

For the more independent-minded person who has a lot of extra time and patience, a third option is the hardest and re-

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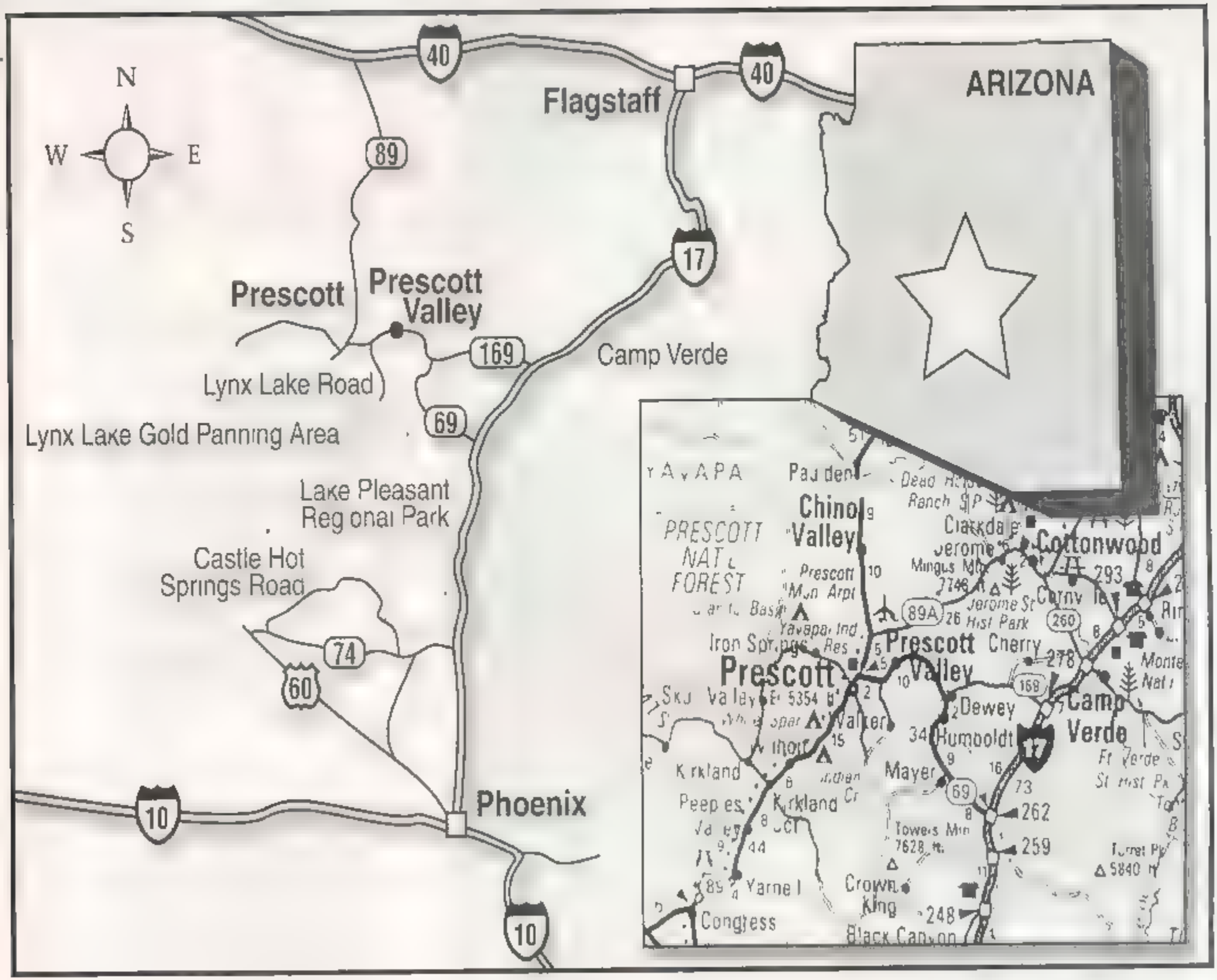

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Cottonwood
Prescott Mun Arpt
Jerome St Hist Park
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Dewey
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Kirkland
Mayer
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Kirkland Jct
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Yarnell
Crown King
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Congress
Black Canyon

Contact Information for Public Lands

Apache Sitgreaves National Forest
928) 333 4301

Coconino National Forest
,928) 527-3600

Coronado National Forest
520) 670-4552

Kaibab National Forest
(928) 635-8200

Prescott National Forest
344 S Cortez St
Prescott AZ 86303
(520) 77 4700

Tonto National Forest
602) 225-5200

Maricopa County Parks and Recreation Department
411 N Central Ave
Suite 470
Phoenix AZ 85004
Lake Pleasant Park. 520) 501 1702
(602) 506 2930

BLM Arizona State Office
222 N Centra Ave , Suite ,01
Phoenix, AZ 85004-2203
(602) 417 9200

Kingman BLM Field Office
2475 Beverly Ave
Kingman, AZ 86401 3629
(520) 692 4400

Phoenix BLM Field Office
21605 N 7th Ave
Phoenix, AZ 85027
(623) 580-5508

Safford BLM Field Office
711 14th Ave
Safford, AZ 85546-3321
(52) 348--400

San Pedro BLM Project Office
1763 Paseo San Luis
Sierra Vista, AZ 85635-2240
(520 458 3559

Tucson BLM Field Office
12661 E Broadway
Tucson AZ 85748-7208
(520) 722-4289

Yuma BLM Field Office
2555 E Gila Ridge Rd
Yuma AZ 85365 2240
(928) 317 3200

quires the most work before ever getting gravel in your gold pan. After determining that an area has a good chance of having gold, research the ownership of surface and mineral rights to discover whether the site is open to being claimed, and find out whether or not it is already claimed. Two books published by the Arizona Department of Mines and Minerals can help: *Laws and Regulations Governing Mineral Rights in Arizona* and *Manual for Determination of Status and Ownership, Arizona Mineral and Water Rights*.

Karyn Harbour of the Tonto National Forest main office in Phoenix says that, like the BLM's mining laws, National Forest rules and regulations do not differentiate between commercial mining operations and recreational uses. They prohibit "significant disturbance of the environment," the meaning of which can vary depending on the area. Harbour says, "In an extremely sensitive area such as a riparian area, any disturbance would be too much, while on the desert floor it would be less crucial." In Tonto National Forest, the lands bordering all rivers and lakes or reservoirs have been withdrawn from mineral entry since the early 1900s to protect the watersned. In addition, the highway department has a right of way of about 1 mile along each side of the roads, inside of which no prospecting is allowed.

Harbour suggests this approach when finding out the availability of a specific location within a national forest in Arizona.

1. Contact the BLM in Arizona. They have records of all claims on all public lands in the state. With the township, range and section, their computers can tell you quickly (and for free) if there are any mineral claims on the land. No claim jumping is allowed.

2. Call the national forest district station for the area of interest to find out whether the area is open for entry.

3. Be ready to give detailed plans for your gold hunt, including the tools to be used.

Harbour says chances are fair that if all you want is to go out for a day of nonintrusive panning, it would be approved.

In addition to the Lynx Lake Mineral Withdrawal Area, other lands within Prescott National Forest are open to similar gold hunting, but require a free permit to be obtained from the Forest Service. There are many claims within this forest, and it is the responsibility of the individual to determine whether an area is already claimed. To do so, a spokesman suggests visiting the county recording office of the desired area; maps and claims are on file there.

Apache-Sitgreaves and Kaibab national forests have no areas for gold hunting because, according to a spokesman, there is not really any gold in these areas.

So, now that you've chosen an area or a club, how do you go about finding gold in a landscape? Again, a look at how gold behaves will help. Because gold is so dense, (14 to 19 times heavier than the same volume of water), it sinks fast and first as water slows or spreads out. In a hilly or mountainous area known to hold gold, look at small canyons and washes leading out of the hills. Look for places in a riverbed where the water slows down or swirls around obstructions. The heavy gold tends to settle out here, just as it does in a gold pan. And being heavy, given enough time, it will work its way down through sand and gravel right to the bedrock. It will always be working its way downstream, downhill, down into cracks and crannies.

Diane Bain, in her excellent book *Gold Panning in Arizona*, published by the state Department of Mines and Mineral Resources, says that about 600,000 ounces of placer gold have been extracted from Arizona since the first recorded discovery in the 1850s. It is estimated that 80 percent of the world's gold still lies undiscovered. Maybe it seems like all the "easy" places are already picked clean or off limits. But who knows? If there's all that gold out there just waiting to be found, why shouldn't it be you who finds it? After all, isn't the excitement and enjoyment of the search what makes it all worthwhile?

There's gold and it's haunting
and haunting
It's luring me on as of old,
Yet it isn't the gold that I'm wanting
So much as just finding the gold
It's the great big broad land
way up yonder
It's the forests where silence has
lease,
It's the beauty that thrills me
with wonder
It's the stillness that fills me
with peace

FIELD TRIP

TAU

A Vein Deposit Provides Unexcelled Collecting Opportunities

by Kenneth H. Rohn

Huge float boulders of colorful, banded agate and milky quartz lie scattered about the hilltop and at the edge of the mine. (Photos by the author)

While touring the Great Circle Route around Lake Superior on Trans-Canada Highway 11/17 recently as luck would have it, I happened upon the Thunder Bay Agate Mine. I was making my way through rush hour traffic in the twin cities of Port Arthur Fort William, Ontario, now known as Thunder Bay, when I saw its sign at the intersection of Highway 11/17 and provincial Highway 527. The mine headquarters is one-half mile from this junction on provincial Highway 527.

Throughout history, many discoveries

NDER BAY
Lace Agate

have been made due to providence, good luck or whatever. This site was one of those discoveries. During a logging operation in 1987, a bulldozer blade, clearing the way for a road, struck the top portion of an agate vein. What a vein it was!

All logging work ceased while the crew investigated this most unusual anomaly. It was soon learned that a large area, encompassing the entire hill and hillside being logged, held evidence of more exposed outcrops of agate veins. Workers also discovered huge float boulders right on top of the hill, weighing more than the strongest man could lift. They were scattered at random, and hidden by grass and underbrush. Many of them consisted of beautifully grained, multicolored agate.

A claim was soon filed for mineral rights, but no work was done at the time. In 1995, the present owners brought the claim up to date and began mining operations. As of this writing, no blasting has been done, and for good reason. Any explosion set off on top of, or near an agate vein of this type would most certainly destroy it. The end result would no doubt be a pile of fractured, mostly unusable pieces. So all excavating has been done with a bulldozer.

Since that first beginning in '95, it has been estimated that the mine holds in the neighborhood of 500 tons of lace agate, all in shallow outcrops very near the surface. The tops of some veins are only few inches below the thin topsoil—a rare and classic example of massive amygdaloidal structure. The exciting aspect of this is the undoubted possibility of many more hundreds of tons yet to be discovered on the property.

In July 1997, the mine was officially opened to the public as a fee-collecting site. Visitors can dig their own semi-precious gem material, or simply collect fine specimens that are already exposed on the surface from previous mining operations.

I drove the short distance to the mine office from the main highway and inquired about the proceedings. The young lady behind the counter told me that they're open from May 15 through Oct. 15, and during midsummer they remain open from 9 a.m. till 8 p.m. daily. She then told me that I could drive the short distance to the mine parking area, around the side of the huge hill that dominates the landscape, and park. From there it's but a short walk to the diggings, where several pits have been opened, with exposed agate veins clearly visible amongst the rubble. The mine encompasses several acres on the sloping hillside as of this writing.

I met Krystal Maunula, a congenial tour guide and the owner's daughter, at the entrance gate. She gave me a most educational and interesting talk about how the mine was discovered, what it consists of, and the present work being done, plus tentative plans for the future. That future presents a great opportunity for innumerable rock hounds not unlike myself to be able to collect magnificent specimens—some of huge size—at this site, for a long time to come.

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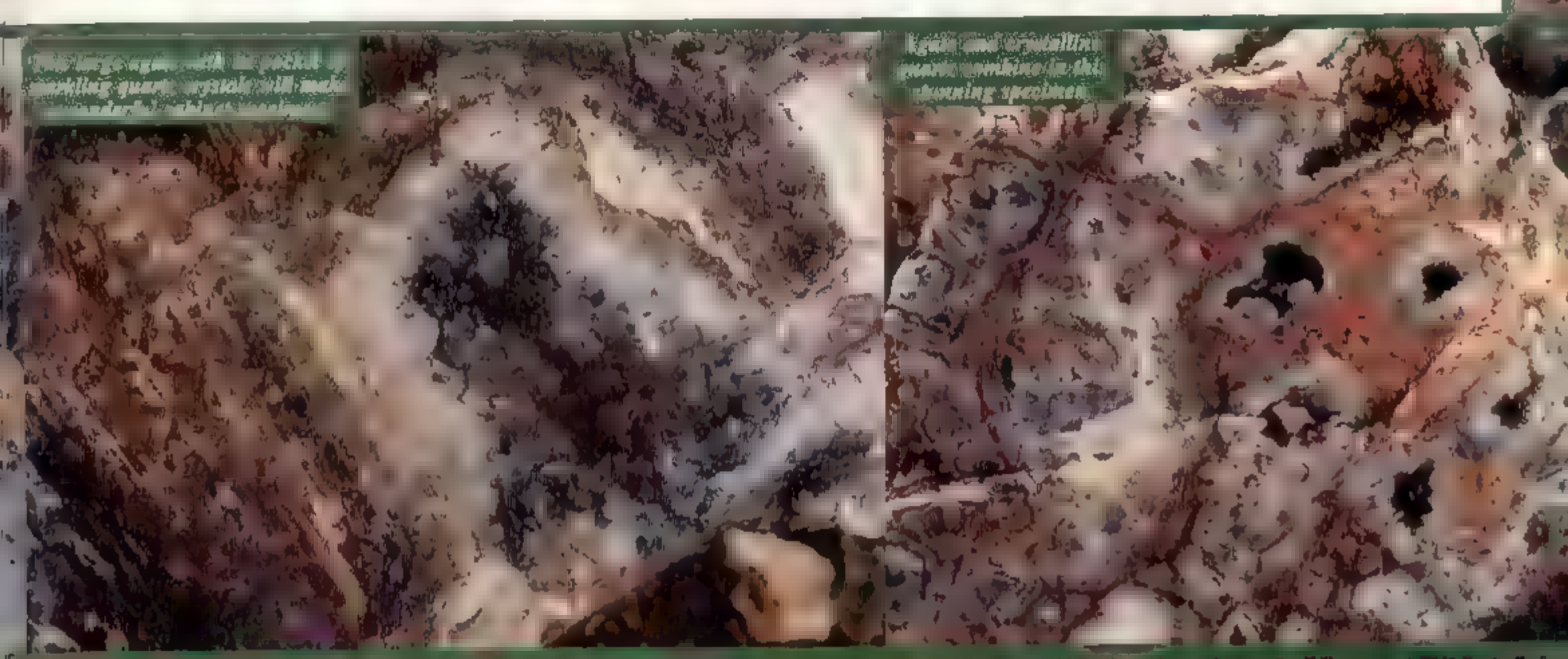


Thunder Bay Lace Agate *from page 53*

We parted company when other rock hounds came into the mine area, and I was left to my own devices. I could dig almost anywhere I chose in the shallow pits, or simply collect whatever stones I found lying on the surface. This was no problem because the ground is littered with the most unusual specimens of lace agate that I have ever seen, and they come in all sizes, from pieces as small as a walnut, to massive chunks. The larger pieces would be difficult to lift and carry to my vehicle without some means of transport. I spent a good deal of time simply admiring all those wonderful stones lying about. The veins were outstanding, with the most unusual patterns and bands. One or two were at least 3 feet thick, running in a more or less gradual sloping, horizontal direction toward Lake Superior.

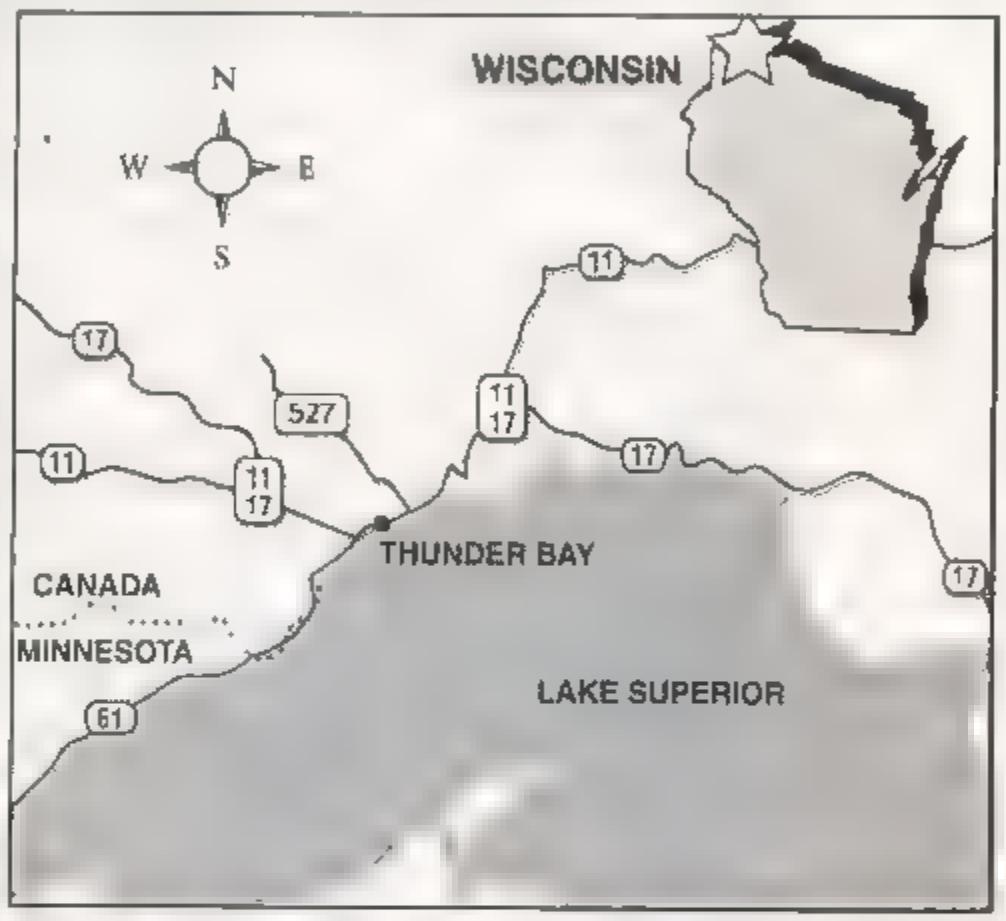
I busied myself collecting from the myriad pieces on the surface. If one were to expose an area of new material by digging a bit, it would be possible to open a cavity in a vein and discover rare stalactites of pure chalcedony. This most unusual and quite unique phenomenon of agate stalactites has been discovered in cavities here at the mine. It would be a great experience for any collector to be able to uncover one of these rare gemstone formations.

On the mine trail, there is a case displaying a beautiful stalactite, as big around as a man's fist, with the top sliced off and polished, revealing the most pleasing bands of cream, gray, black, brown and white throughout. As of this writing, to my knowledge, no stalactites have been recovered here.

An agate (chalcedony) stalactite forms, for all intents and purposes, much like an icicle. But instead of taking mere hours or days to form, as an icicle does, the agate stalactite may have taken eons to form. Of course, this hypothesis is open for discussion, as no humans were around at that time to document the process. It would be a once-in-a-lifetime discovery for any rockhound to be able to uncover one.

The Thunder Bay Agate Mine exhibits another most unusual phenomenon. Agate layers, or bands were formed at random in cracks and voids in the host rock. There's nothing unusual about this, but in this instance, instead of igneous rock making up much of the matrix, quite often you'll find massive crystalline quartz mingled right in with the agate. I found pieces of igneous rock with thick layers of crystalline quartz attached to them, and numerous, perfect circles of agate imbedded right in the surface of the quartz. Also, many botryoidation forms were present, often in the same piece of material. Several of these strange agate forms were merely thin rings composed of almost microscopic bandings. I like to call it "crazy" lace agate, because it resembles Mexican agate by the same moniker.

Another unique feature of this mine is the very fact that the in situ veins of agate have rested undisturbed since their creation. Most of the veins discovered here to date are from 3 to 4 feet thick! No one knows yet how far they extend in this area. They may run all the way to the shore of Lake Superior, possibly even to The Sleeping Giant, an offshore island resembling the silhouette of a man lying on his back, or possibly farther out into the great lake. One thing is certain: There's a wealth of material to be collected at the mine, and will be for a long time to come.



Normally, we find agate nodules of varying size and fragments in gravel pits, road cuts and excavations, and on rocky beaches on inland lakes, such as Lake Superior. As a rule, they are found not far from where violent volcanic eruptions took place in the dim, distant past.

After these eruptions, the great Ice Age covered this land with thousands of feet of solid ice. There were intermittent periods of warm weather before another glacier formed, to the extent of many thousands of years. When these huge bodies of ice moved, they gouged away almost everything in their path, right down to the hardest bedrock. Evidence of this violent period of our earth's history can be seen almost everywhere in this area of Ontario. Massive bodies of very hard igneous rock lie exposed, particularly along the shores of Lake Superior. Today, you'll find many areas where little or no topsoil covers that rock, even though the last glacier passed this way some 11,000 years ago! Generally, these exposed bodies of rock are rounded over, with telltale gouge marks cut deeply into them. One can even determine the direction that the last glacier took by studying these marks.

Thus, glaciation formed the modern-day terrain here in the northland. In the process, untold megatons of agate material were torn out of the lava beds and rolled along under these massive bodies of ice, finally coming to rest as nodules and fragments of semipolished agate. Quite often, the size and smoothness of any specimen can give an indication of just how far it may have traveled from its original cavity or bubble.

Massive moraines consisting of millions of tons of gravel, sand, mud and various amounts of agate material often have traveled a great distance from their formation point. In Ontario, and also parts of northern Minnesota, especially close to the shores of Lake Superior, travel was practically nil. Many nodules that are picked up on the beaches still retain their original shape, including the lumpy, dimpled surface peculiar to these gemstones, which means that they have traveled a very short distance.

For some strange reason, the chalcedony veins in the Thunder Bay Mine were undisturbed, and we find the material just as it was formed, very close to the surface. There most certainly must have been some glaciation close by, plus erosion throughout the ages, but it bypassed much of the mine area. So what remains is one of a very few areas in the entire world where agate veins are present. Two other known locations are in Mexico and Brazil.

It was sprinkling slightly when I took rock hammer and bag into the Thunder Bay Agate Mine. I had been dodging rain squalls for most of that morning, photographing the highlights of the mine. But now it actually seemed to be clearing up, with tiny patches of blue appearing here and there in the otherwise gray, somber sky. It had rained heavily the night before—a typical northern thunderstorm—and the ground was still very moist in places, but it wasn't muddy. There were so many beautiful pieces of lace agate practically everywhere I looked that I didn't know where to begin. The pits were littered with material. Some of the large boulders held potential, if one wished to work a bit with hammer and chisel. Naturally, the matrix is composed of super-hard rock and it would be a chore, but the results could be fantastic. Care must be taken while pounding on a rock, because any blow not aimed

correctly could spell disaster by shattering what might have been a nice specimen. If you do use a hammer, by all means, wear protective goggles or glasses.

I spent a most pleasant day at the mine. I tried very hard to be selective, taking only those pieces that I thought might make good specimens for my display cabinet, but the pounds added up rather quickly. I found two list size pieces that are literally covered with circles, rectangles and many other forms of fortification. The coloration ranges from creamy white to brown, black and orange, with sparkling crystalline quartz surrounding the agate in many instances. I even discovered a thin layer of common opal on two of the specimens I had collected. One has agate bands mingled with massive, crystalline quartz, plus a thin layer of creamy opal on the bottom. Another magnificent specimen has the above formation minus the opal, but contains a cavity of smoky quartz crystals.

After I had wandered around from pit to pit, picking up what I felt I wanted, I returned to the mine office with my rock bag bulging. The young lady who waited on me washed, weighed and packed my collection.

I felt that the prices charged, $8 Canadian per pound of field run stone, were reasonable, considering the amount of work and expense it took to produce this mine. You can have your massive material cut for 50 cents per square inch and polished for 75 cents per square inch.

I had a ball at the mine, and the weather even cooperated during the afternoon, so I didn't get wet. The Thunder Bay Agate Mine has great potential for those artists who wish to carve large figures from this wonderful material. In the shop, I saw some huge pieces that were being sliced. One beautiful, banded specimen was at least 8 inches in diameter. It had the most pleasing patterns and formations in it, impossible to describe properly. I also took photos of several very large cut and polished stones on a table outdoors. Few adjectives can describe their beauty.

So if you're in the neighborhood of Thunder Bay, Ontario, perhaps on vacation or trying your hand at collecting amethyst at the many mines in the area, it will be an educational, interesting and productive experience to try your hand at mining your very own vein of lace agate. This is one of very few places in the world that holds this type of treasure agate still in the form of large veins. You won't be disappointed. I certainly wasn't.

For more information, call (807) 683-3595 or visit the Web site www.agatemine.com.

ROCK SCIENCE

by Steve Voynick

Think Zinc

Most mineral collectors are familiar with zinc minerals, which include sphalerite (zinc sulfide), the most common zinc mineral and the metal's primary ore; zincite (zinc oxide); the spinel-group members gahnite (zinc aluminum oxide) and franklinite (zinc iron oxide); hardystonite (calcium zinc silicate); willemite (zinc silicate); and bright blue aurichalcite (basic zinc copper carbonate). Arguably the most attractive zinc mineral is smithsonite (zinc carbonate), which is perhaps best represented by the beautiful green-blue botryoidal specimens from Magdalena, New Mexico.

Fewer collectors, however, are as familiar with metallic zinc. After aluminum and copper, zinc is the third most-used nonferrous metal. But since zinc does not serve structural or electrical applications, its importance is less readily apparent.

Zinc minerals are fairly abundant and have been known since antiquity. But because of zinc's high chemical reactivity, the metal does not occur freely in nature. When chemists finally isolated and identified zinc as an element until 1746, they found a bluish-white, brittle metal about as dense and as common as copper. For more than a century, zinc had but a single use: mixing with copper to make brass alloys. Even as late as 1890, zinc had such low demand and value that many miners considered it merely an undesirable component of certain lead-silver ores.

Only when iron and steel production boomed around 1900 did zinc finally become a bona fide industrial metal. Although iron and steel made superb structural metals, they corroded rapidly in oxygen environments. Preventing that corrosion was a job perfectly suited for zinc. A thin coating of zinc, applied either by electroplating or "hot dipping" in molten metal, greatly extended the life of iron and steel products ranging from water buckets to structural girders by providing both physical and electrochemical protection.

Although zinc is itself very susceptible to oxygen corrosion, it quickly forms a surface film of zinc carbonate, which prevents further corrosion of the zinc coating and of the underlying iron or steel. Zinc also provides "sacrificial" protection even if the coating is broken. Because oxygen reacts much more readily with zinc than with iron, the electrochemical activity that occurs when galvanized iron is immersed in aqueous salt solutions takes place on the zinc, rather than on the iron.

When zinc bars, called sacrificial anodes, are bolted to the exteriors of ship hulls below the waterline, the substantial electrochemical activity associated with seawater exerts itself on the zinc bars, slowly dissolving them rather than corroding the steel hull plates, thus greatly extending hull life.

Half the zinc used today goes into steel coatings. Seventeen pounds of zinc protect the steel frames and body panels of the average new automobile. And since it's easily die cast, zinc is the metal of choice for everything from collectible, miniature model automobiles to automotive door and ignition locks. Zinc batteries can store six times as much energy per pound than other battery systems. Thanks to advanced, long-life zinc-air batteries, laptop computers can operate for more than 12 hours between recharges.

Zinc compounds have an array of different applications. Zinc oxide, or "Chinese white," is used as a white paint pigment and in topical skin ointments, while zinc chloride is a wood-preserver ingredient. Zinc sulfide, a synthetic form of sphalerite with many valuable electroluminescent, photoconductive and semiconductive properties, is the primary phosphor coating in television tubes and fluorescent-light tubes.

Each year, industry uses some 8 million tons of zinc, which is supplied jointly by 260 mines worldwide and a huge recycling industry. At 51 cents per pound, zinc costs about the same as lead, but is considerably cheaper than copper.

Zinc is also essential for human health, regulating the function of more than 300 enzymes in the body. The human body actually contains about three grams of zinc, and the recommended daily dietary allowance is 15 milligrams.

Despite their color, all those shiny "copper" pennies in our pockets consist of 98 percent zinc. So, while its uses are not nearly as familiar as those of copper, aluminum or lead, zinc is always closer than we might think. ■

Rock&Gem

THE EARTH'S TREASURES • MINERALS & JEWELRY

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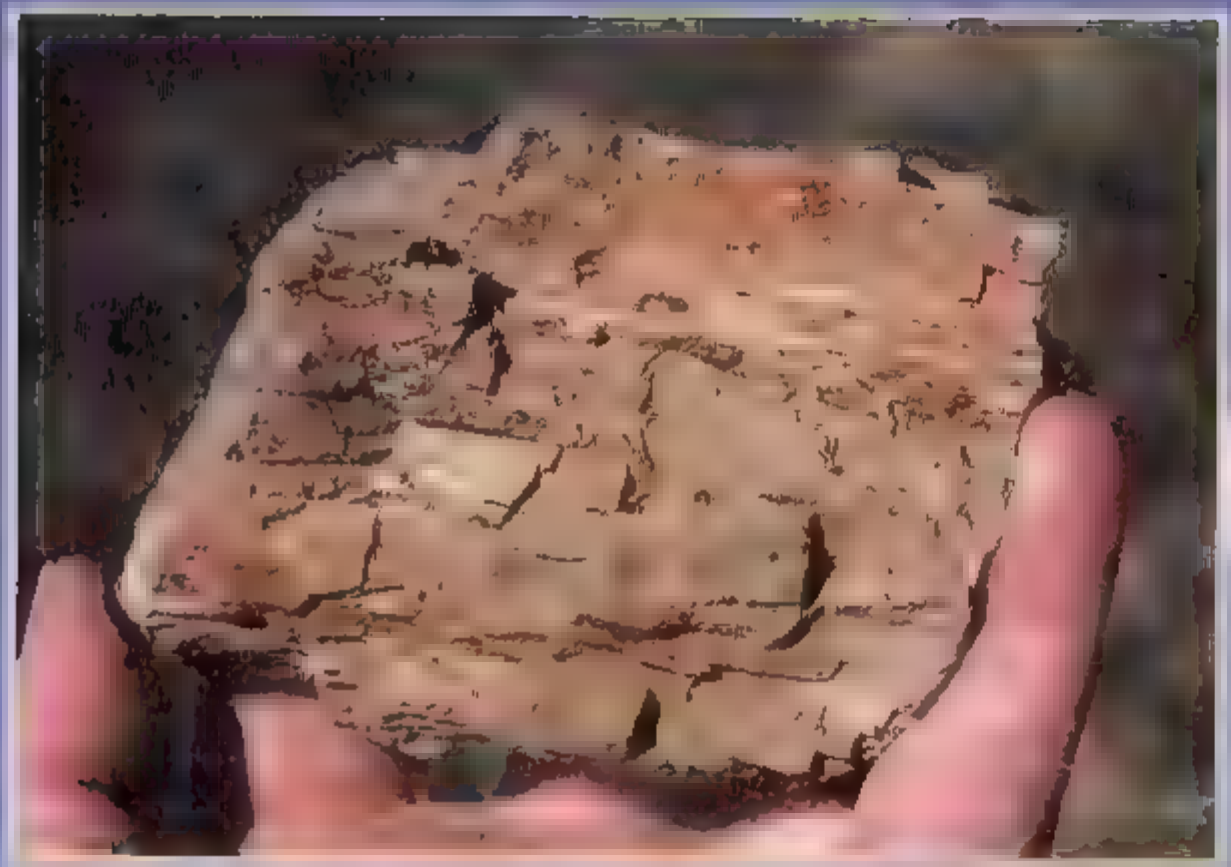
NEW MEXICO'S Bisti/De-Na-Zin Wilderness

These Badlands Represent a Rare Paleontological Window

...ritual rain if eroded away ... sands creating the maze of ... canyons, cliffs, mounds and pinnacles that characterizes the badlands. (Photo courtesy the NM State Office BLM)

Thin, erratic gypsum seams are common in badland sediments. The gypsum often takes the form of lustrous satin spar (above). (Steve Voynick photo)



Most petrified wood in the Bisti Badlands is buff to mahogany in color, and some is of polishing quality. (Steve Voynick photo)

The arid, weathered landscape of the Bisti Badlands resembles a lunar topography. (Photo courtesy the NM State Office BLM)

by Steve Voynick

Most of us will never know what it's like to walk on the moon, but the second-best experience might be a hike through New Mexico's Bisti Badlands. With no water, little plant life, and a bizarre, contorted topography of colorful cliffs, gullies, spires and giant mushroom-shaped rock formations, the badlands seem more lunar than terrestrial.

Neither the name "badlands" nor its definition—arid, heavily eroded regions with scant vegetation—convey a particularly inviting image. But for anyone interested in the earth sciences and in starkly beautiful scenery, the Bisti Badlands are worth a visit. The region is a paleontological treasure, a repository of interesting rocks and minerals, the product of a fascinating story of geological creation, and a textbook example of the effects of rapid and extreme erosion.

The Bisti Badlands are a 400-square-mile area of strangely sculpted rock formations that consist of interbedded layers of shale, siltstone, mudstone and sandstone. Ongoing erosion continually exposes many animal and plant fossils, petrified wood, seams of selenite and satin spar, lignite and bituminous coal, with occasional bits of amber and nodules with crystalline interiors of barite, calcite and siderite.

The Bisti Badlands are located in the center of the San Juan Basin, a geological depression covering much of northwestern New Mexico. Its exposed, fossil-rich sedimentary strata were laid down between 60 million and 70 million years ago, a geological time span in which paleontologists have a special interest. Because these sediments host the fossil record of the boundary of the Cretaceous and Tertiary periods, they represent a rare paleontological "window" into the sudden transition from the Age of Dinosaurs to the Age of Mammals.

continued on next page

New Mexico's Bisti/De-Na-Zin Wilderness *from page 81*

The Bisti Badlands is a 30-minute drive south from the city of Farmington, New Mexico. While the drive is short, the journey itself transports visitors from irrigated green fields near the San Juan River to arid badlands, from civilization to wilderness, and from the present into the geologic and paleontological record of the distant past.

Seventy million years ago, the Bisti Badlands were a low-lying coastal plain where a moist, subtropical climate supported a profusion of late Cretaceous life. Many streams meandered across the plain to empty into the Interior Seaway, an inland sea that divided North America into eastern and western island continents. Aquatic flora and fauna, the latter including many turtles and crocodiles, flourished in the warm waters, while dense forests of redwoods, pines, palms and ferns bordered the coastal plain. Dinosaurs, ranging from small coelurid and large tyrannosaurid carnivores to ankylosaurs (armored dinosaurs), hadrosaurs and horned pentaceratops, roamed the land. During this time, which would soon become a critical juncture in evolution, a variety of small, primitive mammals coexisted with the dinosaurs.

Detail of a 6-inch fossil fern found in the Bisti Badlands. (Steve Voynick photo)

This coastal plain underwent radical change some 65 million years ago, when stresses generated by colliding tectonic plates buckled the earth's crust in western North America, slowly uplifting great blocks of basement rock to displace the inland sea and create the Rocky Mountains. The crust in northwestern New Mexico stretched, then subsided to form the San Juan Basin. Subsequent erosion of the surrounding highlands slowly filled the basin with fine sediments, creating a near-ideal environment for the fossilization of flora and fauna.

Some 63 million years ago, a time which paleontologists consider to be the Cretaceous-Tertiary boundary, life on Earth was suddenly altered. According to current theory, the explosive impact of a large meteor generated enormous clouds of dust that enveloped the planet. As temperatures plummeted, dinosaurs and other life forms quickly became extinct, while mammals developed and proliferated rapidly.

Thirty million years later in mid-Tertiary time, renewed tectonic stresses slowly uplifted the American Southwest to its current elevation, ending sedimentary deposition in the San Juan Basin and initiating slow erosion. Much later, during the relatively recent Pleistocene ice ages, massive alpine glaciers scoured the San Juan Basin, removing thousands of feet of accumulated sediments.

When the glaciers finally receded some 10,000 years ago, torrents of glacial runoff rapidly eroded the center of the San Juan Basin. This process of selective erosion wore away the softer strata quickly, but left the durable rock in place, thus creating the maze of gullies, small canyons, cliffs, mounds and spires that characterize the Bisti Badlands today.

Bisti (rhymes with "pie") is an Anglo derivation of *pistxahi*, the Navajo word for "shale hills." The badlands seemed to have little mineral potential except for exposed coal seams, which miners began working on a small scale in the 1870s. Coal miners' reports of large "stone bones" in the badlands attracted the attention of paleontologist Edward Drinker Cope, who identified the fossil bones as those of dinosaurs. More importantly, Cope also found some of the earliest mammal fossils known at the time—the remains of small, primitive, rodentlike animals that were at the beginning of their evolutionary development.

During the 1950s, core-drill exploration showed that the mineral wealth of the badlands far exceeded the small surface coal seams that had been mined for decades. Core samples revealed deeper, more massive coal seams, along with commercial deposits of petroleum and natural gas trapped in a complex strata of "source" and "reservoir" rocks. The source rocks are Cretaceous-age sediments rich in organic matter that had decomposed to produce the petroleum and natural gas. The overlying reservoir rocks are impermeable, fine-grained sandstones of very late Cretaceous and early Tertiary ages. After forming in the lower source rocks, the petroleum and natural gas had migrated upward to collect in "pools" beneath the impermeable reservoir rock.

By 1975, petroleum and gas exploration surveys in the badlands had helped paleontologists locate more than 200 paleontological sites containing the fossilized remains of 200 species of plants and animals, including invertebrates and such vertebrates as fish, amphibians, reptiles, dinosaurs and mammals. Many fossils are holotypes (specimens used for original descriptions of species) that have been found nowhere else.

The Bisti Badlands took on additional paleontological significance in the early 1980s, after researchers linked the Cretaceous-Tertiary dinosaur extinction to a cataclysmic meteoritic impact. Geophysicists theorized that the resultant dust clouds were rich in iridium, a platinum-group metal rare on Earth but relatively abundant in meteorites. That dust had eventually settled to form a thin, but identifiable, sedimentary layer that precisely marked the Cretaceous-Tertiary boundary and the end of the Age of Dinosaurs. The Bisti Badlands, one of only four places in the world with large exposures of Cretaceous-Tertiary boundary sediments, yielded early evidence of the iridium-rich layer that supports the now widely accepted impact theory of dinosaur extinction.

In the early 1980s, the Bureau of Land Management (BLM), which administers large sections of the Bisti Badlands, petitioned Congress to protect the area from the adverse environmental impact stemming from the development of gas and petroleum exploration roads. Congress enacted the San Juan Wilderness Protection Act of 1984, which created two nearby, but nonadjoining, wilderness areas: the 4,000-acre Bisti Wilderness and the 24,000-acre De-Na-Zin Wilderness areas. "De-Na-Zin" is derived from the Navajo word for cranes, pictographs of which are found not far to the south. By 1996, the BLM had acquired 16,000 additional acres of land, making it possible to combine the two wilderness areas into the 45,000-acre (70-square-mile) Bisti/De-Na-Zin Wilderness.

Federal law mandates that wilderness areas must be managed for the use and en-

joyment of the American people in a manner that will preserve them for future use and enjoyment, and protect their wilderness character. Accordingly, the use of motorized and mechanized vehicles, as well as mineral and fossil collecting, are prohibited in the Bisti/De-Na-Zin Wilderness.

Wilderness regulations allow scientific research and paleontological excavation, but make such activities considerably more difficult. In 1998, the BLM authorized the New Mexico Museum of Natural History and Science to excavate dinosaur fossils in the Bisti/De-Na-Zin Wilderness, but only after being assured that any disturbed land would be restored. The museum excavation team recovered a rare, complete, fossilized *Parasaurolophus* crest. Paleontologists have since used a reconstruction of this hollow crest to speculate on the actual sounds of dinosaur "calls."

A year later, the New Mexico Museum of Natural History and Science recovered another remarkable fossil from the Bisti/De-Na-Zin Wilderness: the skeleton of a large *Albertosaurus*, a 30-foot-long cousin of *Tyrannosaurus rex*, and a formidable predator that attacked in pairs and small groups. The *Albertosaurus* specimen is the most complete skeleton of a carnivorous dinosaur ever recovered in New Mexico.

Unable to use motorized vehicles, the museum's paleontologists and volunteers had to camp two miles from the dig, then pack in their materials, tools and drinking water every morning. The bones that they recovered, when encased in plaster, weighed several tons, and removing them from the wilderness required the use of a New Mexico Army National Guard helicopter.

Today, a visit to Bisti/De-Na-Zin is a true wilderness experience. With no trails, hikers may roam where they wish except, for reasons of both preservation and safety, on the more delicate geological features. The wilderness is open all year, and seasonal precautions are in order. Summer temperatures can be extremely hot, while winter days may be bitterly cold. Hikers must pack their own drinking water and be alert for flash floods, which can be dangerous, in the dry washes following summer thunderstorms. The best times of year to visit are late spring or fall.

Because the unusual topography can make map reading and land navigation confusing, most hikers follow the washes, carefully noting their surroundings to help in retracing their route.

Most of the exposed strata in the badlands are part of the Fruitland and Kirtland formations. The Fruitland Formation sediments, most prominent in the eastern, or De-Na-Zin, part of the wilderness, appear as interbedded strata of sandstone, shale, mudstone, coal and silt. The younger, overlying Kirtland Formation, best seen in the western, or Bisti, section, consists mainly of varicolored shales.

The most distinctive of the bizarre rock shapes in the badlands are hoodoos, spires with large, mushroomlike caps. The columns are of softer Fruitland sediments, while the caps consist of the more durable Kirtland shales. "Hoodoo," an anglicized African word for "spirit," aptly describes the eerie formations.

Hikers will also encounter distinctive, brick-red outcrops of "clinker" that cover more than 100 acres and rise 30 feet high. Clinker beds, which formed when the natural burning of coal beds baked the overlying shales and sandstones, contain many reddish plant impressions that contrast vividly with the buff and lighter-red matrix clinker rock.

Erosion is a double-edged sword for the badlands' paleontological resources: it quickly destroys exposed fossils while continually exposing new ones. Rainfall, which averages just 9 inches per year, is the greatest agent of erosion. After the heaviest rains, which occur only every second or third year, the coffee-colored runoff that surges through a single gully may carry as much as 30 tons of sediment per minute.

While collecting minerals and fossils is strictly prohibited in the Bisti/De-Na-Zin Wilderness, sections of the adjacent badlands do offer collecting opportunities. Land ownership in the badlands, however, is complex and divided among the BLM, the state of New Mexico, and the Navajo Nation, all of which have different collecting regulations. Remember that unauthorized collecting of vertebrate fossils on federal land is prohibited, and that collecting on Navajo land requires tribal authorization.

Where collecting is permitted, however, rockhounds can gather an interesting array of rocks and minerals. Petrified wood, usually buff or mahogany-brown in color, often shows the bark and grain details of the original wood. Some opalized wood is also present, and fossils of marine shells appear as dark concretions in the sides of washes and cliffs.

Varicolored agate and yellow jasper, along with abraded clear and milky quartz crystals up to 2 inches in length, occur in surface gravels. Dark, iron-stained concretions up to a foot long are common, and many contain crystalline centers of clear calcite, clear and bluish barite, clear and yellow selenite, and yellow-brown siderite. Gypsum, as selenite and lustrous satin spar, can be collected from thin seams. And collectors have even found bits of yellow and orange amber in the thin, erratic seam exposures of brown lignite and black bituminous coal.

Selenite is another form of gypsum that occurs in seams in the badland sediments. (Steve Voynick photo)

The Fossil Forest Research Natural Area is New Mexico's premier petrified wood occurrence. The 2,770-acre Fossil Forest—which is near, but separate from, the Bisti/De-Na-Zin Wilderness—was recognized by Congress in the San Juan Basin Wilderness Protection Act of 1984 as an area that contains "paramount aesthetic, natural, scientific, educational and paleontological values." Many of these values are vested in an unusual concentration of petrified wood that includes 11 logs and 40 stumps, some of the latter still standing in their original upright positions.

The Fossil Forest is protected as a natural area, meaning that collecting and the use of motor vehicles is prohibited. Although open to the public, it is located in a remote, unmarked area. To protect the Fossil Forest as a paleontological resource for research purposes, the BLM does not encourage visitation.

Today, most of the 11,000 individuals who travel each year to the Bisti/De-Na-Zin Wilderness visit the more readily accessible western Bisti section. To reach the Bisti/De-Na-Zin Wilderness, follow state Route 371 south for 36 miles from Farmington, New Mexico, or 70 miles north from Interstate 40 and Thoreau, New Mexico. To reach the Bisti parking area on the western end of the wilderness, turn east on Road 7260 and follow the graded gravel road for two miles. The Road 7260 turnoff is 1.5 miles north of the highway bridge where state Route 371 crosses De-Na-Zin Wash.

To reach the De-Na-Zin parking area and the eastern part of the wilderness, follow state Route 371 from the Bisti access road south for eight miles, then turn east on County Road 7500 and follow the graded gravel for 14 miles. Eight miles beyond the De-Na-Zin parking area, County Road 7500 connects with state Route 44. County Road 7500 may be impassable in wet weather.

After a hike into the lunarlike topography of the Bisti Badlands, and through the sediments that mark the end of the Age of Dinosaurs and the rise of the Age of Mammals, you'll come away with a better sense of geologic time, a new respect for the process of erosion, and a bit more appreciation for those strange areas we call "badlands."

by Bob Jones

A Rare Opportunity at Kartchner Caverns

In the December 1999 issue of *Rock & Gem*, I announced the opening of a fantastic new cave in Arizona called Kartchner Caverns. The cave consists of huge chambers, each stunningly decorated with limestone formations of every type, description and color. We now know the caverns boast the longest soda straw stalactite in the world—over 21 feet long. A half-dozen cave-type minerals have been identified there, minerals found only in one or two other locations in the world. But the amazing thing about this cave is that it is alive and well in spite of being visited by thousands of people since it was opened less than two years ago. The reason is that the state of Arizona has made Herculean efforts to maintain the integrity of the cave while making it accessible to visitors, including the handicapped. It is one of the few caves anywhere that is totally wheelchair accessible.

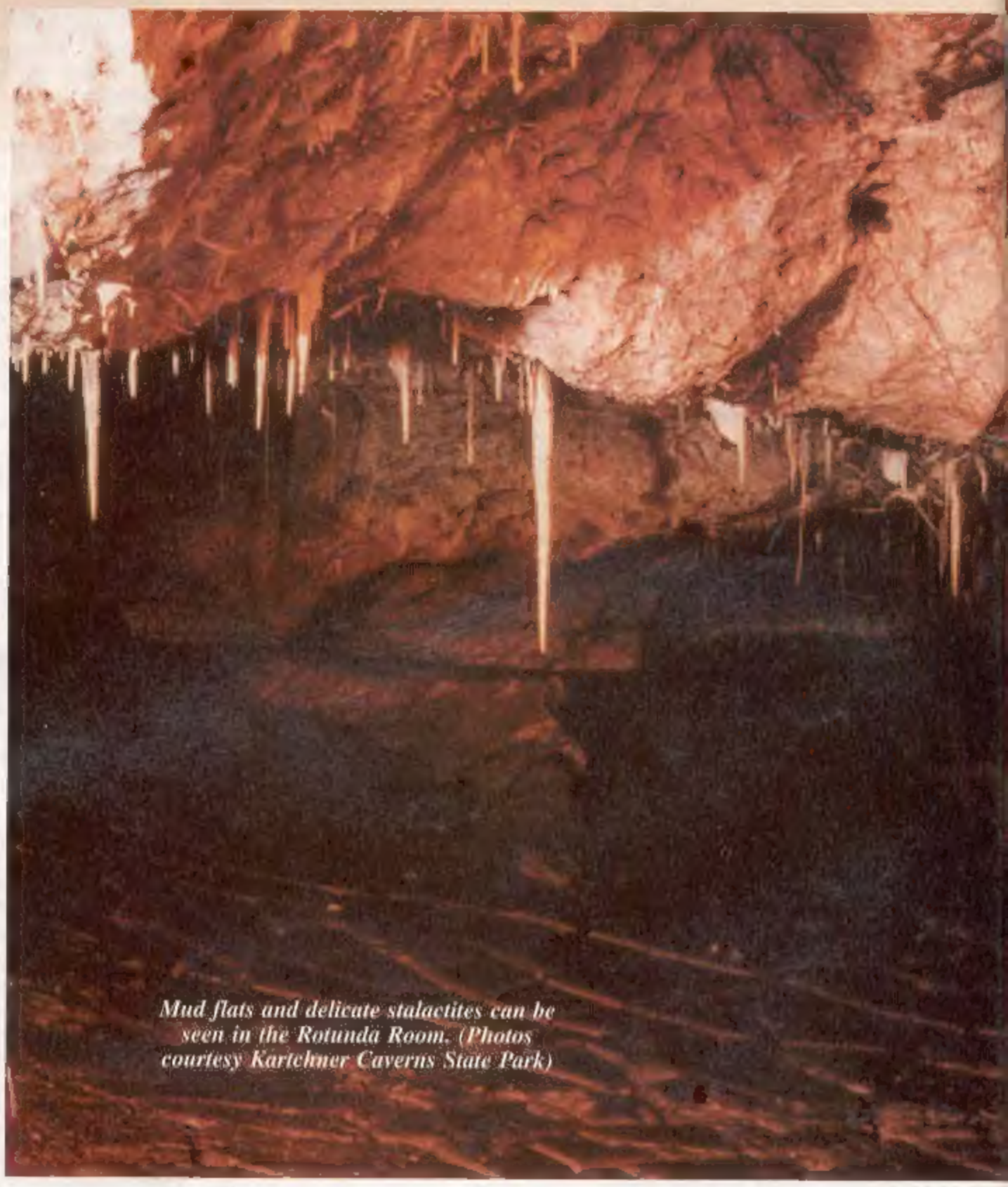
Kartchner Caverns has been designated an Arizona State Park, designed to preserve it as a living cave. The stunning and colorful formations in the caverns are still developing and growing. Stalagmites over 50 feet high can be seen. Its soda straw stalactites, those long, hollow tubes that descend from the ceiling, are among the finest in the world. That 21-foot soda straw is estimated to have taken a half-million years to form. Kartchner Caverns is now ranked among the top 10 limestone caverns in the entire world!

There are huge limestone flows, myriad stalactites and stalagmites, and nearly transparent ribbonlike formations that look like bacon hanging from the ceiling. The caverns hold sterling examples of just about every conceivable cave formation known to spelunkers.

When the cavern opened to the public, one chamber was kept closed—the one in which thousands of bats spend their summers, breeding and raising their young. While conserving that bat chamber, known as "The Big Room," state officials made plans to open it on a part-time basis when the bats left for Mexico.

Now how would you like to go spelunking in that forbidden chamber? You will be able to do so in about two years. Or you can make a significant donation and visit it now *and* bring along your camera, a once-in-a-lifetime chance to take pictures where the activity is normally forbidden.

The Big Room is still closed and will not be open to the public anytime soon, but I've been given permission to offer rockhound and mineral club group hard-hat tours—spelunking field trips so to speak—into The Big Room before the completion of work to open it to the public.



Mud flats and delicate stalactites can be seen in the Rotunda Room. (Photos courtesy Kartchner Caverns State Park)

The preparation of The Big Room is going to be pricey, and the whole idea here is to raise money. So, organized groups can now arrange for exclusive sneak-peek spelunking tours into The Big Room for a fee. Keep in mind, this portion of the cave has not been seen by anyone but state officials and cavern employees.

The Big Room holds the most colorful cave formations I have ever seen: stalactites and stalagmites that are pink, orange and brick red. The formations in one area are so red that the room is called "The Strawberry Chamber." Other formations challenge your imagination as they form all sorts of weird and wonderful shapes.

So, the time has come for you to don a hard hat for a private guided tour into that forbidden chamber! Work is nearly finished on this

Above: The Kartchner Caverns Visitor Center is beautifully designed to blend into the desert landscape. Below: The 23,000-square-foot Discovery Center houses world-class exhibits, including a replica of the cave, regional and interactive displays, and educational information.

closed section of the cavern, and your club can have an exciting experience that the public won't be able to enjoy anytime soon. You can sign up ahead of time for one of these tours. I urge you to do it.

Before you venture underground, you have to understand how this came about. Developing that final section of the cavern has taken a huge amount of money. To give you an idea, the state had to spend over $25 million dollars to develop the cavern as it was opened to the public in 1999. All the work was done by hand: The tons of concrete used for the trails, curbs, seats and the like were mixed by hand and carried into the caverns in buckets! Misting systems to maintain the exact humidity, computers to monitor the cave, special lighting, sound systems, and double air-lock doors to control the caverns' environment are just some of the works that added to that huge cost. To preserve this amazing living cave, such measures were absolutely necessary.

So it is with this new chamber. Costs will be very high. To help offset the expense, some public-spirited people have formed the volunteer group Friends of Kartchner Caverns State Park. Fundraising is the primary goal of this group. I have been appointed liaison to bring the mineral community on board. After all, who but spelunkers and rockhounds have a greater interest in the earth and its natural features?

What is exciting about all this is the fact that the State Parks Department has given the Friends permission to organize private guided tours into the new Big Room chamber before it is open to the public. Along with the tour, these lucky people will enjoy very special privileges. "Hard hat" means you're going to see things and go places the public will not be able to. The groups will be small, about 10 to 15 per guide. The hard-hat tours will be much longer than the planned general public tours.

If you have been to Kartchner, you know that cameras are completely off limits—*except* for those of you who join us on a hard-hat tour. That's right! Those who participate in this fundraising event will be the only people ever to be allowed to *bring a camera* into this pristine limestone cavern. Think of it! You will be able to get pictures of these amazing features and even get a shot of yourself right there where no one has ever been allowed to pose for a photograph. That alone is worth the price of admission from my point of view.

To give you an idea of how exclusive this photo opportunity is, when I toured the cavern four months before it was ever opened to the public, I was not allowed to take pictures, even for *Rock & Gem!* Now you can do something I was not allowed to do!

Since the whole idea of this is to raise funds to help develop the caverns, the suggested donation for the tours is $150 per person. If your club is interested in doing a little spelunking into The Big Room and in having an exclusive opportunity to get photos for personal use, contact me by e-mail at suesjones@wans.net. Better yet, wait until you get to Tucson and sign up at the Kartchner Caverns Information Tables set up at several shows.

Individuals can sign up, joining groups where space allows. Businesses, club groups, and corporations can participate, becoming a sponsor or partner with the Friends. Sponsorship of a Web page will put your group or business name on the Kartchner Caverns Web site. Benefits include an opportunity to hold a private event for up to 40 guests at the park site, which includes the cavern tour and a reception hosted by Friends of Kartchner Caverns.

To arrange a tour for your club or to become a sponsor or partner, contact me or call Friends of Kartchner Caverns at (602) 224-0040.